Calhoun: The NPS Institutional Archive

DSpace Repository

Theses and Dissertations 1. Thesis and Dissertation Collection, all items

1987

Design constructibility reviews.

Winsper, Loretta E.

http://hdl.handle.net/10945/22230

Downloaded from NPS Archive: Calhoun

DUDLEY KNOX LIBRARY

http://www.nps.edu/library

Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943

DUDLEY KNOX LIBRARY
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA 93943-5002

DESIGN CONSTRUCTIBILITY REVIEWS

BY

LORETTA E. WINSPER

A REPORT PRESENTED TO THE GRADUATE COMMITTEE
OF THE DEPARTMENT OF CIVIL ENGINEERING IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF ENGINEERING

UNIVERSITY OF FLORIDA

Spring 1987

T233789

Thesis
W65245
c.1

TABLE OF CONTENTS

PAGE

Introduction 1

Section One - Purpose of the Review 4

Section Two - Rights and Responsibilities .. 12

Section Three - Current Practices 16

Section Four - Mechanics of the Review 24

    Guidelines 27

    Checklists 64

Section Five - Recommendations.............. 72

Section Six - Summary 75

Appendix One - Record of Interviews 77

Appendix Two - Publication Excerpts 82

References 105

Bibliography 107

DESIGN CONSTRUCTIBILITY REVIEWS

Introduction

The design constructibility review has received greater emphasis over the last few years as a means of curbing the rising cost of construction and the trend towards litigation in contract disputes. A process which was once taken for granted as part of the design procedure has now become an item unto itself. Owners have been driven to this because of the number of claims made by contractors due to inaccurate, incomplete or ambiguous plans or specifications, and because the owner is becoming less satisfied with the quality of work he is receiving. The designers are not completely to blame. In high inflationary times, once a project has been funded, it must be designed and constructed as quickly as possible to maximize the construction obtainable within available funds. Although large federally funded projects will be designed prior to construction funding, smaller projects funded at the activity level are designed and awarded in the fiscal year. Adequate review can be time consuming and costly, and until recently, was considered a luxury. With the current trends in the construction industry, the design constructibility review is quickly becoming a necessity.

> "Constructibility is the practicality of a project design, including the clarity of the contract documents to be understood, priced, administered and enforced. Constructibility reviews assure that drawings and specifications do not contain significant errors, omissions and ambiguities. Accomplishment of constructibility reviews sufficiently in advance of advertisement is essential to assure that adequate time exists for correction of deficiencies. It must be emphasized that constructibility reviews are not a substitute for the designer's responsibility to check the accuracy and completeness of drawings and specifications before they are submitted for review." (21)

This definition is found in the forward to the Naval Facilities Engineering Command publication P-446, Constructibility Reviews. It emphasizes that the constructibility review should not be confused with a technical review. Technical adequacy is the responsibility of the designer and should be reviewed by the project engineer with the design firm if questions should arise. This review is also not a functional review. The owner, in conjuction with the designer, should determine the functional requirements of the facility and the most effective means of implementing those functions. The requirements should be fixed by the 35% design review. (19) From this point, design and administrative initiatives are based on the fulfillment of these functions.

Constructibility encompasses the entire construction process from the owner, designer and constructor points of view. The project manager must keep these three perspectives in mind as the contract is reviewed. In line

with the technical and functional reviews, constructibility could be considered the "administrative" review. The main concern is to ensure that the contract documents accurately detail the work to be done and adequately address known factors which might affect the accomplishment of that work. Although other aspects of the project might be included, the primary objective of the constructibility review is to ensure that the job can be accomplished as the contract documents describe in writing and depict in the plans, and that one document does not contradict another.

The method of review varies from organization to organization, as does the experience of the individual assigned to accomplish the review. In order to ensure that even an inexperienced project manager performs an adequate review, guidelines should be established to cover the major points of concern. The simplest means of performing such a review is through use of a checklist procedure. Organized in a manner to facilitate use with a variety of contract subjects, a checklist can provide guidance to the reviewer, document discrepancies and establish a vehicle for feedback on the items in question.

SECTION ONE

PURPOSE OF REVIEW

Professionalism

One reason to perform a review of any kind is to ensure that the work being accomplished meets the standards set by the firm or the individual. A reputation is based on the accuracy and completeness of the job performed. To a professional, his reputation is his livelihood. While the term professional has many connotations, the Labor Management Relations Act, as amended in 1947, defined the term "professional employee".

The term "professional employee" means:

> a. any employee engaged in work (1) predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical, or physical work; (2) involving consistent exercise of discretion and judgment in its performance; (3) of such a character that the output produced or the result accomplished cannot be standardized in relation to a given period of time; (4) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher

learning or a hospital, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine mental, manual, or physical processes; or

b. any employee, who (1) has completed the courses of specialized intellectual instruction and study described in clause (4) of paragraph (a), and (2) is performing related work under the supervision of a professional person to qualify himself to become a professional employee as defined in paragraph (a). (27)

While this definition lists four requirements necessary to be considered a professional employee by legal standards, most professionals also must be registered by a state licensing board and usually belong to a professional society. These societies represent the interests of their members and serve as administrators of the standards set by their profession. The National Society of Professional Engineers (N.S.P.E.), which is comprised of engineers of all fields, has established a Code of Ethics as guidelines for their members to follow and although these codes have no legal basis, they are very effectively enforced through peer pressure. The American Society of Civil Engineers has chosen to define a "profession" less technically than the Labor Relations Management Act, yet the connotations of the

word are more completely described. As published in their Official Register:

> A profession is the pursuit of a learned art in a spirit of public service ... [and] is a calling in which special knowledge and skill are used in a distinctly intellectual plane in the service of mankind, and in which the successful expression of creative ability and application of professional knowledge are the primary rewards. There is implied the application of the highest standards of excellence in the education fields prerequisite to the calling, in the performance of services, and in the ethical conduct of its members. Also implied is the conscious recognition of the profession's obligation to society to advance its standards and to prescribe the conduct of its members. (1)

Professionalism cannot be decreed. It is a learned behavior reinforced by personal satisfaction in the job accomplished and by recognition as a competent individual in the field. A professional should take those actions necessary to ensure that the work he has produced is of the highest caliber of which he is capable. In the case of a project manager, this means performing an adequate review of the contract documents to minimize confusion in the bids and costly

changes to the owner. It includes looking out for the owner's interest while ensuring the contractor is afforded the opportunity to accomplish the job and receive consideration for his work. Finally, the project manager will conduct a proper review which considers the impact of the contract work on the health, safety and welfare of the public and corrects deficiencies in the safety measures required.

Cost Reduction

Although one would like to believe that professionalism alone instigated the call for improvement in contracting procedures, the driving force behind the push was more likely a need to identify cost reduction actions. The rising costs of construction resulting from changes made after contract award creates many problems for the owner working with a fixed budget. Besides increased costs, additional contract time is often associated with change orders due to contract document errors, omissions or ambiguities. The time involved can lead to more problems if it affects other areas of construction or if seasonal weather problems become a factor not previously considered in the contract. Time is money, and lost or delay time can result in a very expensive change order to a contract.

Liability

Liability has become a topic of increasing concern, as both owners and contractors look to the responsible party to cover their losses. Legally, liability may be covered under the law of torts, or wrongs. There are two categories of torts, intentional and unintentional, also known as negligence. (13) An intentional wrong, with the proper evidence to prove it was intentional, always incurs liability on the wrongdoer. Negligence, on the other hand, can be difficult to prove. The doctrine of negligence states that "every person owes to every other person the duty to exercise reasonable care and skill in the performance of its duties to avoid injuring the other person." (14) Reasonable care and skill is based on the actions of an average reasonably prudent person. This definition is far from definitive and is the crux of many liability suits.

In addition to accusations of negligence, contract interpretation disputes have caused an increase in litigation. The intent of the contracting parties, as expressed in the printed contract, is determined in order to make equitable compensation. Errors, omissions and ambiguities can lead to a misinterpretation of the intent of the contract. Court rulings abound in this area. The general philosophy is that "an interpretation which gives a reasonable meaning to all parts of an instrument will be

preferred to one which leaves a portion of it useless, inexplicable, inoperative, void, insignificant, meaningless or superfluous; nor should any provision be construed as being in conflict with another...[Hol-Gar Mfg. Corp. v. United States, 169 Ct. Cl. 384, 351 F.2d 972 (1965)]." (15) Also, the court will not "reject nor treat as redundant or meaningless, any part of the contract if meaning reasonable and consistent with other parts may be given it or if the contract may be construed with the word or words left in [Beagle-Chilcutt Painting Co., 60-2 BCA 2731 (1960)]." (16) Generally, in instances where the contract documents lead to some confusion, the courts will rule against the party responsible for preparing the document. "Since one who speaks or writes can by exactness of expression more easily prevent mistakes in meaning than the one with whom he is dealing, doubts arising from ambiguity of language are resolved in favor of the latter [4 Willison, Contract, 3d ed.,para.621, 1961]." (17)

Most contracts will require that bidders report obvious mistakes in the contract to the owner's attention. Contractors have been denied claims for errors which they should have caught, however the trend seems to hold the owner responsible for ensuring the documents are free of glaring errors. Although some contractors get a reputation for being change order claim "artists" by bidding error-ridden contracts low and making their profit on the

claims, it can be very difficult to prove that a contractor knew of the error prior to award. Large, complex projects with multiple and substantive addendums and modifications are prime candidates for high change order rates.

The insurance industry's response to the increase in litigation has been to increase premiums for owners, designers and contractors, alike. In the United States, the insurance industry collects an estimated $249 billion in premiums each year. Insurance companies claim that in 1985, they paid out $1.18 in claim settlements and associated expenses for every $1.00 in premiums collected and were simply not prepared for the sudden outlay of funds. They blame the increase in settlements on the courts being overly sympathetic to the plaintiffs and on lawyers "creating" cases. Consumer advocate groups blame the insurance industry for poor investment policies, resulting in their lack of ability to meet their financial responsibilities. The 1986 Florida Legislature passed "radical" tort reform concerning the insurance crisis. In addition to other measures, this reform repealed the doctrine of joint and several liability for claims in excess of $25,000. As defined by Black's Law Dictionary, "a liability is said to be joint and several when the creditor may sue one or more of the parties to such liability separately, or all of them together at his option." (2) This doctrine has been known as the "deep pocket" rule. If there are three defendants

found responsible in a liability lawsuit and only one is financially able to pay the amount awarded the plaintiff, that individual must pay the full amount. The courts felt that the plaintiff had the right to the award by whatever means the defendants could make the payment. Opponents to this doctrine argued that it punished those who carried insurance or had other financial resources. Groups advocating the tort reform, such as Project Civil Reform, were only partially pleased with the legislation. In addition to other tort reform, the Florida legislature mandated a freeze on insurance premiums in the state. The effect of this legislation has not yet been fully realized, but two major insurance companies decided to immediately stop writing new policies in Florida. This could lead to firms not being able to get insurance at any price. Self insurance among large firms or insurer's groups amoung construction organization members have become viable alternatives. Such a trend could lead to increased emphasis on contract reviews and improved construction practices in order to reduce the possibility of claims against the organization's own "insurance monies."

SECTION TWO

RIGHTS AND RESPONSIBILITIES

Duty of the Reviewer

The individual reviewing the contract documents for constructibility will normally be the project manager assigned to administer the contract once it has been awarded. In order to perform a proper review, the reviewer needs to be familiar with the scope of the project, the general construction techniques and the rights and responsibilities of each of the parties involved, mainly the contractor, the designer, the owner and the general public affected by the construction.

The Contractor

The contractor has the responsibility to execute the intent of the contract in a workmanlike fashion using the reasonable care and skill expected of an average prudent man in his trade. His work should be commensurate with the compensation he receives. He has the responsibility to report to the owner any glaring mistakes he finds in the contract documents while he prepares his bid. He is governed by local building codes and should not violate those codes even if the specifications indicate otherwise. Such contradictions should be brought to the owner's attention. A contractor has the responsibility to ensure

the safety of his workers and the safety of the general public at the time of construction and through the life of the facility by adherence to building codes and industry standards.

The Designer

The designer has the responsibility of transforming the owner's ideas and desires into a workable solution, incorporating function and safety as required by law and industry standards. He is required to exercise reasonable care and skill in the performance of his duties. Design liability is cited when this standard has not been met. Details of architectural and engineering agreements will differ, however it is normally the designer's responsibility to ensure that a contract package is technically complete and accurate when presented to the owner for advertisement or negotiation. Unless it has been otherwise arranged, the owner will be responsible for providing the administrative additions to the contract documents. The designer also has rights inherent to every contract. Mainly, he has the right to receive compensation for the work he has performed. Should errors or omissions be found in his work, not due to negligence, he should have the right to correct that work without being liable for resulting problems. Determining reasonable care and skill is not easy and can be taken to litigation for a final decision.

The Owner

Ultimately, it is the owner's decision what is to be included in a contract. The owner is paying for the work and will determine the use of the final product. He has the right to expect work commensurate with the fee he is paying. The owner has many other responsibilities. He must define what he wants from the designer or contractor. If he is uncertain at the onset, then he must work with the designer to clarify the areas of indecision. He must be willing to pay for what he wants. This is the beginning of many problems. The owner needs to be aware of the true cost of a project and be willing to pay that price or cut back on the design. The contract documents detail what the owner is requesting. It is important that he read and understand what is being contracted for in his name. Finally, the owner must realize that both designers and contractors, while exercising the reasonable care and skill required by their profession, can and will make mistakes for which the owner may have to assume financial responsibility. For this reason, many inexperienced owners may choose to hire a construction management (CM) firm.

A construction manager will act as the owner's agent in the administration of a contract. While some firms may have a small construction force, the majority of work will be accomplished by subcontractors. Fee arrangements vary, but a popular method is for the CM firm to work on a fixed fee

established after approximately 60 percent design. This reduces the opportunity for conflict of interest and enables the CM to more effectively operate in the owner's best interest. Any design items which are still in question at 60 percent design can be estimated at one cost and flagged to be adjusted up or down depending on the owner's final decision.

SECTION THREE

CURRENT PRACTICES

Each type of organization in the business of administering construction contracts has developed its own method of performing a constructibility review. Many times it may be accomplished in conjunction with technical and functional reviews and not separately acknowledged, but the essence of the review is being performed.

Private Industry

Two large, nation-wide construction management firms were interviewed concerning their constructibility review procedures. (3,4) The emphasis placed on adequate review of design is evidenced by the experience level of the personnel assigned and the amount of time allocated to perform the coordination efforts. Construction management firms rely heavily on their reputation for success and that reputation is dependent on presenting a completed project on time and within budget. Adequate review is essential to meeting those requirements. One firm designated an individual at the onset of the project to coordinate with the design firm and to carry that project to completion. The reviews were based primarily on that individual's personal experience.(5) The second firm chose to specialize and have an individual exclusively coordinating with the design efforts and

detached from the actual construction phase. The review procedures included contract compliance with a checklist utilized by the firm's estimating department and application of the "project executive's" personal experience. (6) The advantage of the first method is that a key individual becomes intimately familiar with the contract documents and has personal impact on the methods of construction and types of material to be utilized. The second organization, however, allows the development of specialized fields. The individual should be able to quickly identify and correct the common errors or omissions and concentrate on the specific constructibility aspects of the project. The second method must include some form of indirect feedback to the project executive on the course of the construction phase in order to keep him current and prevent similar problems from recurring. The first organization has direct feedback to the individual responsible and could provide valuable lessons for coordination of future projects.

The Redicheck System

The Redicheck system is a standardized method for detecting errors and omissions. It was developed in 1982 by Mr. William T. Nigro while he served in the Civil Engineer Corps, U.S. Navy, at the office in charge of construction, Trident Naval Submarine Base, Kings Bay, Georgia (OICC Trident). He has since started a private practice in which

he trains personnel in his technique and performs consulting work applying the method. Through experience, he found that errors and omissions accounted for almost half of the change orders required on construction contracts. He states in an article outlining his method, "While conducting 100 percent design reviews, it is not unusual to find an average of five coordination errors or omissions per drawing. On an average $10 million project with 100 contract drawings, almost 500 errors can be found." (10) Redicheck focuses on the coordination between disciplines. A CADD system or light table is recommended to facilitate overlaying the drawings and checking for conflicting designs. The typical errors which Redicheck can identify are listed:

> * Structural drawings with column locations and grid lines that vary with architectural drawings.
>
> * Architectural floor plans that do not match other discipline floor plans.
>
> * Architectural reflected ceiling plans that do not match light fixtures on electrical drawings or ceiling grilles/registers on mechanical drawings.
>
> * Electrical drawings that indicate items of equipment with different horsepower ratings, voltages, and phases than mechanical drawings and/or specifications.
>
> * Mechanical drawings that read "see structural drawings for additional roof supports" while the structural drawings do not indicate such supports. (7)

The Redicheck system utilizes the sequence of construction as its guideline, with the civil engineering drawings being checked first, then the structural, underground utilities,

electrical, mechanical and finally the architectural. It emphasizes that it is not a substitute for the technical review. Six guidelines recommended to reduce the risk of error are to "show the right information the least number of times and preferably only once; avoid notes such as "see architectural" or "see structural"; keep the number of drawings to a minimum; avoid match lines; keep the same orientation on all plans; and all wall sections should be shown at relative elevations to each other on the same sheet." (11) For the Redicheck to be most effective, it is recommended that it be applied at the 100 percent design review and that an average of 45 minutes per drawing be dedicated. In the very first year of implementation at OICC Trident, the construction percentage cost of change orders decreased from ten percent to just over two percent. (9) Although the cost and time associated with the reviews was not compared to the projected savings for rate of return purposes, the benefits were certainly realized in both dollars and timely completions.

The U.S. Navy's Guidelines

Use of the Redicheck method for design review is encouraged throughout the Naval Facilities Engineering Command (NAVFAC), however a complete constructibility review requires more than an interdisciplinary check of the plans and specifications. Guidelines for contractural

appropriations are based on the Federal Aquisition Regulations (FAR) and are specifically detailed for Navy contracting in the NAVFAC P-68 Contracting Manual, considered the "bible" for contract administration. Technical specifications and drawings are covered in Section III, Preprocurement Actions, Part 4. This section addresses items such as clarity, performance specifications, "or equal" specifications, proprietary specifications, coordination of specifications and of specifications with drawings, collateral equipment, contractor quality provisions and several other topics. Each section is referenced to the FAR provision which governs. (23) Division One of the specifications is reserved for administrative rather than technical requirements and is covered by Section IV, Part 2 of the P-68. A few of the items addressed in this section are bid items, experience clauses, bonds, assumption of risk, completion dates, liquidated damages, insurance, government furnished equipment and warranties. (24) Section III, Part 4 and Section IV, Part 2 are provided in Appendix Two for more information on the items covered.

While the Redicheck system recommends that the review be conducted at 100% design, the Resident Officer in Charge of Construction (ROICC) contract administration handbook sets review at 95% design. Technical reviews are made at 35% and 95% while funtional reviews are made at 35% design

only, after which time functional requirements should be set. (18) Some aspects of the constructibility review are accomplished at 35% design, such as the interdisciplinary coordination check and value engineering determination. Value engineering is a methodology used to reduce costs or simplify construction processes without degrading the function required. Many times value engineering is associated with reducing the quality of the materials and deleting the "extras" in a project, but an effective value analysis will reduce costs without sacrificing quality or aesthetics. (12) It is important for value analysis to be considered early in a project, but it can be applied at any point prior to and after award of a contract. Many large contracts will include a Value Engineering clause allowing for the contractor to present cost saving ideas with which he might have experience. The 35% review allows for early detection of errors or misunderstandings of what the project is to accomplish. The administrative requirements, however, are not sufficiently detailed to allow for a comprehensive review, although it would be beneficial to have the tentative requirements at this time in order to screen subsequent problems and to research alternative solutions.

By the 95% review, the project is in its pre-final stage. All technical and administrative requirements have been detailed. It is very important that a thorough review be conducted at this point to minimize future problems with

the contract. According to the ROICC handbook, ten working days are allotted for the distribution, review and return of all contract documents. This is necessary to ensure timely completion of the review and subsequent advertisement of the contract. It would be more realistic to set the time allowed for review according to the size and complexity of the project. Adequate review can be time-consuming but will pay for itself by minimizing costly change orders and time extensions due to incomplete and inaccurate contract documents. Documentation collected on the use of the Redicheck system at Trident Naval Submarine Base, Kings Bay, Georgia showed that the percentage of construction costs attributed to change orders decreased from 10% to 2% the first year the system was introduced. (8) Although cost is usually the major concern, time extensions due to change orders can create additional problems. The key to reducing these problems is to control the quality of the contracts being prepared.

One step taken by the Naval Facilities Engineering Command to improve the contracts prepared has been the establishment of the Contracts Quality Assurance Division. This division was extablished in November 1985, in response to several audits and inspections which cited poor contract quality for the increasing cost of contract claims. It is responsible for revising contract procedures, improving contract language to ensure clarity, developing guidelines

for documentation of contractor performance, and determining training criteria for personnel involved in contract quality assurance. One such improvement implemented by the division has been the inclusion of quality assurance of design as a selection evaluation factor in hiring Architect-Engineer firms. An interdisciplinary coordination review has been incorporated into the statement of work for an A-E contract. This has been made a specific cost item in negotiating the A-E fee. The coordination reviews must accompany the design at the 35% and 95% review stages and are spot checked for correction of the errors noted. These changes were incorporated into the P-68 in July 1986, with the addition of Appendix J, Architect-Engineering (A-E) Design Deficiencies: Criteria for Establishing and Processing Possible A-E Contractor Liability. The FAR requires that A-E liability be enforced and monies collected for costs incurred by the government, unless the administrative costs of collecting it would exceed the recoverable costs.(25) This new requirement and the other improvements implemented by the Contract Quality Assurance Division should help to control contract change orders and claims.

SECTION FOUR

THE MECHANICS OF THE REVIEW

The publication of instructions alone will not improve the quality of the contract documents. Guidelines can only be effective if presented in a manner which facilitates the review. They must be detailed enough to cover a wide range of situations and yet not be too cumbersome to use. The NAVFAC Publication-446, Constructibility Reviews, gives general guidelines for the execution of a review. The guidelines are divided into bidding information, general paragraphs, and specifications and drawings. The specifications and drawings section is further divided into divisions which correlate to the Construction Specifications Institute (CSI) standard contract divisions. Using this beakdown of work and a checklist of items to be considered, a very effective review tool is created.

The Redicheck system recommends performing the review in the same sequence as the construction will take place. This allows a logical and complete evaluation of the design. For purposes of a constructibility review, the CSI format allows a standardization of any type of project. Using the Uniform Construction Index (UCI), which was developed for cost analysis purposes, the CSI divisions are further broken down into specialty areas. This type of breakdown lends

itself to a checklist formatted review and to a computer-assisted program which could facilitate the review process. With a proper data base of considerations for each division covered, the reviewer could simply request a checklist of those items pertinent to a particular contract. The checklists could be accessed by inputting the division codes included in the contract documents. The UCI added a Division 0 to the CSI divisions to cover "conditions of the contract." This division could contain items to be considered for bidding information and general paragraphs. The ultimate goal of such a program would be to make as much knowledge available on a subject to a reviewer in a format which reduces the time required to perform the review. For instance, by indicating that site work, CSI division 2, is included in the contract, the program would proceed to ask if certain conditions had been met by the contract documents. A response of yes, no or not applicable would be recorded. Allowance for a remarks section could be included for each item which does not satisfactorily meet the reviewer's criteria. The output report format could take a variety of forms. The reviewer could request a list of all discrepancies by code, with remarks, which could then be forwarded to the designer for consideration. A list of all items could be reported to substantiate that the review had been conducted and the items considered. Such documentation could be very useful should questions later arise.

The checklist items for this report have been taken primarily from the NAVFAC P-446 Constructibility Reviews. (22) Most items have been paraphrased for brevity or clarity, while others have been reproduced verbatim. The order of items has been rearranged to form a more logical sequence of review. Additional sources of consideration were SOUTHNAVFACENGCOM Instruction 11012.10A, Review of Plans, Specifications, and Cost Estimates (26), the CHESNAVFACENGCOM Instruction 4330.62C, ROICC Contract Administration Handbook (20), and limited personal experience. The following narratives explain the items of the checklist by CSI division. These divisions are as follows:

Division 00 - Bidding Information (added)
Division 01 - General Requirements
Division 02 - Site Work
Division 03 - Concrete
Division 04 - Masonry
Division 05 - Metals
Division 06 - Wood and Plastics
Division 07 - Thermal and Moisture Protection
Division 08 - Doors and Windows
Division 09 - Finishes
Division 10 - Specialties
Division 11 - Equipment
Division 12 - Furnishings
Division 13 - Special Construction
Division 14 - Conveying Systems
Division 15 - Mechanical
Division 16 - Electrical

DIVISION 00

BIDDING INFORMATION

Item 1 - Check that the bidding place address and time are correctly shown in the Invitation for Bids.

Item 2 - Check that the plan issue office address and phone number are correct and complete with zip code and area code.

Item 3 - Check that the correct phone number and address is given for bid inquiries.

Item 4 - Check that the correct phone number is given for information on pre-bid site visitation, and that specific times are indicated if necessary.

Item 5 - Verify that the General Description completely covers the primary functions of the contract.

Item 6 - Check that proper forms have been included for contractor to indicate bid.

DIVISION 01

GENERAL REQUIREMENTS

Item 1 - Check for correct bid item wording and correct annotation on the drawings. It is important to distinguish bid items from the basic contract. When multiple bid items are included, the base bid item will be numbered one. Additional items must be able to be bid separately such that any combination of items can be awarded with the base bid (i.e., Bid item 3 cannot be contingent on item 2 being awarded.

Item 2 - Evaluate the reasonableness of the contract completion time. This check should consider availibility of the construction site, seasonal constraints, activity constraints, long lead time material, availability of government furnished material/equipment, and any other factors which might influence the normal construction time.

Item 3 - Check to see if scheduling and phasing of the work, if included, is compatible with the needs of the activity. Each phase should have its own completion date listed.

Item 4 - If multiple completion dates are listed, check to see that liquidated damages are itemized for each phase.

Item 5 - Verify that correct contract numbers, drawing numbers and titles are indicated and that they are consistent with the Table of Contents listing and throughout the documents.

Item 6 - For unit price contracts, ensure that the items for schedule of prices to be bid are complete.

Item 7 - Ensure that any salvage material is clearly identified and that information on when and where and to whom the material is to be delivered is specifically detailed. Check requirements for all material which is to be removed and remain government property to be inspected prior to the start of construction.

Item 8 - Check requirements for a Construction Representative's field office and specify size, type of structure, and utilities allowed.

Item 9 - Verify site conditions! Check to see if existing obstruction are indicated and if existing utilities are clearly marked on the plans and at the site. Have special soil conditions been noted?

Item 10 - Has the type of progress schedule been designated? Is a Network Analysis required for this project?

Item 11 - Check to see that provisions/restrictions for utility outages have been clearly specified!

Item 12 - Check the specifications refering to government furnished equipment/material. Have the items been clearly identified and delivery schedule and location listed?

Item 13 - Are there any restrictions whatsoever at the construction site which will hinder the work of the contractor. Access which is in any way restricted should be clearly explained.

Item 14 - Check that security requirements have been identified as well as any vehicle or personnel passes necessary for the contractor to work in the area.

Item 15 - Check the requirements for any special permits required by local or state agencies. These

permits can seriously delay a contract if not considered ahead of time. Has time been alloted for the obtaining of these permits?

Item 16 - Applicable clauses required for restricted data on computer/EMCS installation should be clearly specified with the requirements clearly listed.

Item 17 - For projects over $2 million, check the requirements for Contractor Quality Control (CQC) provisions. If included, check that the provisions have been edited to suit the particular requirements of the contract; check that the items to be tested are clearly identified and that the testing procedures and acceptable limits are clearly identified; check requirements for experience qualifications for those items requiring a substantial amount of experience; check specifications for factory-inspection of products and for specialty inspections by outside agencies (i.e., hazardous waste disposal compliance inspection by EPA).

Item 18 - Environmental protection requirements should be clearly identified: protection of natural resources, erosion and sedimentation control, dust control, asbestos handling and disposal, and regulations on burning within the construction area.

Item 19 - Check experience clause requirements. Level I, contracting officer approval is required for this clause to be included.

Item 20 - Verify types of bonds required in contract. Bid bonds, performance bonds and payment bonds are required for contracts in excess of $25,000.

Item 21 - Check that proper insurance clauses are included. NAVFACENGCOM contracts generally specify insurance coverage as required by state and local laws or by FAR 28-306-7, whichever is higher.

Item 22 - Is any portion of the contract subject to statutory cost limitations and has this been specifically set forth in the IFB?

Item 23 - Has this contract been considered for small business set-aside?

DIVISION 02

SITE WORK

Item 1 - Verify property line dimensions on site plan with architectural drawings.

Item 2 - Drawings should clearly indicate clearing and grubbing limits.

Item 3 - Horizontal and vertical survey control monuments must be shown.

Item 4 - Profile of underground works (sewer lines, water lines, electrical and communication lines, etc.) should be shown.

Item 5 - Check fence line and grade for conflict with existing structures (e.g., sewer manholes, electrical manholes, water or gas neters, etc.).

Item 6 - Verify all new electrical, gas, water, sewer, etc., lines connecting to existing.

Item 7 - Sewers should be below water lines if they are within 10 feet horizontally. Sewer and water line crossing details should be included in the drawings. Allowable clearances between water and sewer lines under the building should be clearly

shown in detail drawings. Do not install water and sewer lines in the same trench side by side.

Item 8 - Locations and elevations of existing underground obstructions should be clearly indicated on the drawings (e.g., cables, abandoned pipes, old foundations, log, etc.).

Item 9 - Borrow and waste areas including truck routes to the construction sites should be clearly indicated on the drawings.

Item 10 - Dump sites:

(a) If excavation is included in the project, is a dump site clearly identified in the plans and specifications? Is a distance given? Is it correct? Is a permit required?

(b) Is the dump site on or off station?

(c) Is the customer fully aware and in agreement?

Item 11 - Check schedule of availability of the areas to be demolished. Provide notice to station prior to demoltion. How much time is necessary for area to be vacated, traffic rerouted, etc.?

Item 12 - Demolition requirements should address the following:

(a) Phasing of work (salvage operations, demolition and disposal) and

(b) Coordination with other phases of the construction.

Item 13 - When Test Piles and Pile Load Tests are specified, verify that drawings show number and locations of these piles.

Item 14 - Drawings must include boring logs and soil classification along with ground water level.

Item 15 - Check possible requirements for dewatering operation at proposed excavation areas.

Item 16 - Specifications should have proper and sufficient sheeting and shoring requirements for the job and state that those materials will be on the site prior to starting excavation operations.

Item 17 - Verify line and grade of ditches particularly on "Match Line" (i.e., often the line and grade of the same ditch are erroneous and will not match).

Item 18 - Check project drawings for location and extent of the various types of pavements.

Item 19 - Know location of all hand holes, manholes, observation risers and other structures or features to be installed within the pavement area.

Item 20 - Drawings should indicate total thickness of each base course type (check pavement details). Verify cross-section indicated to insure that it agrees with specifications for base and sub-base courses, and wearing course.

Item 21 - Has provision been made in the specifications for positive control of the temperature of the bituminous material?

Item 22 - Test results on samples of asphalt, aggregate, sand and mix should be obtained from the plant prior to placing any bituminous concrete.

Item 23 - The specification should also establish criteria for maintenance of landscaping such as frequency of irrigation, mowing and fertilizing if this is deemed necessary.

Item 24 - In phased work, can irrigation systems be provided in phases to new and/or existing landscaping?

Item 25 - Check the number of trees and shrubs shown on the landscaping planting plan with their corresponding quantities shown on the "Plant Legend" or "Tree and Shrubs Schedule."

Item 26 - Do not plant trees over sewer or other underground utility lines or beneath overhead lines where they will interfere when mature.

Item 27 - Types of fertilizer, times of application and the amount to be applied each time should be included in the project specifications. Does the host activity require that all fertilizers, including type, amount and method of application be cleared through the local Pest Control shop?

Item 28 - Specifications should require that before planting trees and shrubs, the contractor must investigate the possibility that the site may have previously been treated with herbicides or soil sterilants and make sure that soil condition is suitable for planting.

Item 29 - Existing trees to remain within an area should be protected from accidental damage with barricades or wooden planks strapped around their trunks.

Item 30 - Is the customer aware of the trees and shrubs to be removed? Could some be relocated? Are any, of special interest to local organizations who would resist their being destroyed?

DIVISION 03

CONCRETE

Item 1 - Review specifics on concrete mix design, placement, curing and finishing. Include concrete testing requirements.

Item 2 - When there is a requirement to test the cement, a sample from the mill which supplies the job, or preferably from the job itself, should be shipped in air-tight containers.

Item 3 - Specifications should state within how many days (minimum) or percent of concrete strength achieved that removal of forms may commence on different types of concrete structures.

Item 4 - All Portland cement to be used in the concrete for any indiviual walk, curb or gutter should be of the same brand and type.

Item 5 - For large pavement (e.g., aircraft parking apron, taxiway, runway, etc.) specification requirements should include preparation of "paving and jointing" plan for ROICC approval.

Item 6 - Minimum required cover over reinforcing steel for exterior concrete surfaces exposed to the weather and for interior concrete surfaces not exposed to weather conditions should be stated in the specifications.

Item 7 - Specifications should require that all reinforcement should be supported and wired together before pouring concrete. Is there enough room for reinforcing bars and other embedded items?

Item 8 - Drawings must include reinforcing bar splicing details. Is overlap specified?

Item 9 - Specification should state the type of finish needed to achieve a functional slab. Important points of the specifications are:

(a) slope floors to drains;

(b) bleed water should be removed only by dragging with rubber hose over the surface and not by dusting with dry cement to absorb water.

Item 10 - Project specifications should specify a minimum curing period for cast-in-place concrete before permitting the application of primer and subsequent work for built-up roofs.

Item 11 - Specifications should include the recommended/acceptable Casting and Erection Tolerances of precast panels.

Item 12 - Strand ends of pre-cast panels must be recessed and backfilled or otherwise carefully protected to avoided corrosion.

Item 13 - Plans and specifications should limit the number of cut strands in the members during coring or cutting planks.

Item 14 - When prestressed products are factory fabricated, specifications require the adherence to catalog guarantees as to capacities, dimension tolerances, and permissible alterations in the field, such as coring for utility lines.

Item 15 - Prestressed concrete shop drawings shall include, but not be limited to, the following items:

(a) bed layouts;

(b) cable tensioning data;

(c) sequences for stressing and detensioning (releasing).

Item 16 - Ensure all slab finish elevations are indicated on the drawings. Pay particular attention to depressed or raised slabs.

Item 17 - Verify perimeter slab on structural drawings matches architectural drawings.

Item 18 - Verify all columns and beams listed on column and beam schedules. Check location and size. Also check against architectural drawings.

Item 19 - Verify expansion joints throughout building. Check locations against architectural drawings.

Item 20 - Check building elevations against floor plans and building sections against elevations and plans.

Item 21 - Check wall sections against architectural building sections and structural drawings.

DIVISION 04

MASONRY

Item 1 - Specifcations should identify all the requirements if a sample of masonry is needed.

Item 2 - Is full-time inspection by special inspector required/necessary on masonry work?

Item 3 - Verify masonry openings for windows and doors. Check against architectural drawings.

DIVISION 05

METALS

Item 1 - The specifications should clearly identify which materials or components (e.g., steel trusses, beams, girders, etc.) are to be factory inspected.

Item 2 - Make sure that detail of all major structural steel connections in the project are shown in the drawings.

Item 3 - Make sure that stud types, sizes and spacings are spelled out in the plans and specifications.

Item 4 - All welders that will be assigned to the project should possess a certification that he/she passed

the qualification tests in accordance with the appropriate section of the American Welding Society Standard D1.1 within the past 12 months.

Item 5 - Are miscellaneous metal items described adequately?

Item 6 - Verify structural members (columns, beams, etc.) against column and beam schedules and architectural drawings.

Item 7 - Check column lengths against column schedule.

Item 8 - Verify roof framing column lines and columns against foundation column lines and columns.

Item 9 - Verify perimeter roof line against architectural roof plan.

Item 10 - Verify expansion joints throughout building. Check against architectural drawings.

DIVISION 06
WOOD WORK

Item 1 - The specifications shall cover such items as grades, moisture content, size and pattern, surface texture and grain of materials for finish carpentry and mill work.

Item 2 - Specifications should state width, length, method of nailing or fastening and materials to be used for fastening finish carpentry and mill work.

Item 3 - Specifications should indicate that oversize cuts and holes will not be permitted during cutting and boring for service runs in order to minimize strength reduction of structural members.

Item 4 - Verify all cabinets will fit.

DIVISION 07

THERMAL AND MOISTURE PROTECTION

Item 1 - Specifications should indicate roofing inspection requirements.

Item 2 - Specifications should indicate the items required for test cut (i.e. size of test cut, where it should be taken, how often test cut will be done, etc.).

Item 3 - Include pre-installation conference requirement in the specifications to make sure the thickness of the roofing insulation, the number of layers, and the method of application are understood by the contractor and workers.

Item 4 - Contract documents should clearly indicate which surfaces are to be dampproofed.

Item 5 - Specifications should indicate the acceptable range of moisture contents and surface moisture.

Item 6 - The type of expansion joint's sealant material must be identified on both plans and specifications (e.g., asphalt-latex emulsion, hot-poured rubber-asphalt, premolded joint filler, etc.).

Item 7 - Specifications should indicate sealant amount of coverage per lineal feet on joints of various widths and depths.

Item 8 - Specifications should include a provision to insure that all items (i.e., drains, curbs, wood cants, vents, pipes, etc.) which penetrate the built-up membrane are in place before laying any plies.

Item 9 - Specifications should require that roof insulating materials are to be kept dry before, during and after applications.

Item 10 - Materials at the job site should be properly and neatly stacked, with protective covering if necessary, to minimize damage.

Item 11 - It is mandatory that the top surface of the exposed roofing be given a glazed-coating if the work stops for any reason; i.e., bad weather, night fall, or a large volume of work on the roof by other building trades.

Item 12 - The rate of application of the hot bitumen over the top ply should be specified.

Item 13 - For safety, bitumen heating kettles must not be put on top of any building.

Item 14 - If appropriate, notify local fire department that roofing work is taking place over specified dates.

DIVISION 08

DOORS AND WINDOWS

Item 1 - Verify building elevations against floor plan openings, paying particular attention to window and door openings.

Item 2 - Verify building sections against elevations and plans, noting window and door openings.

Item 3 - Verify all door schedule information including sizes, types, labels, etc. Look for omissions, duplications and inconsistencies.

Item 4 - Door hardware schedule should provide the following information for each item of hardware: model number, finish, sizes and types of fasteners, including any designation of optional features or acessories.

Item 5 - Make sure that all "Detail Numbers" for doors and windows as shown on the floor plans have a corresponding detail on the architectural drawings.

Item 6 - Verify measurments of doors and windows as soon as they are delivered on site.

Item 7 - Specifications should include provisions on how delivery, storage and handling of doors and windows will be done by the contractor on different types of doors (metal doors and wood doors).

Item 8 - Glass and glazing specifications should address the following items: sash preparation, glazing clearances, glass selection, glass preparation and glass positioning.

Item 9 - Specifications for glass and glazing should indicate that installation of glass and glazing materials should not be attempted when the

temperature is below 40 degrees Fahrenheit to avoid moisture being trapped which will cause failure of the weathertight seal.

Item 10 - Keying system requirements should be coordinated with the needs of the using activity. When a new system is to be an extension of the existing system, state manufacturer's name of the existing system.

DIVISION 09

FINISHES

Item 1 - Compare architectural finish schedule to specification index. Insure that all finish materials are specified.

Item 2 - There should be provisions in the specifications for exterior and interior plastering concerning temperature and ventilation control for proper curing and drying.

Item 3 - Surfaces requiring waxing and buffing should be spelled out in the contract documents.

Item 4 - Specifications should indicate what surfaces require no field painting, what surfaces come to the job site already primed and painted, how many

coats each surface is to receive, the type of primer, intermediate and finish coatings each surface is to receive, and the color and gloss of the finish coat to be applied to each surface.

Item 5 - Specifications should indicate the paint minimum and maximum coverage per gallon or the dry film thickness for each type or kind of paint material.

Item 6 - Specifications should indicate whether patched/repaired areas are to be painted. Provide color schedule.

Item 7 - Areas in plenum or attic which are to be plastered as required for fire protection or sound barriers should be clearly marked in drawings. (This area is often overlooked by contractors and inspectors.)

Item 8 - All fire rated walls should be clearly identified on the drawings (floor plans, sections and wall schedule.)

Item 9 - Check drawings to determine which walls terminate at ceilings or at the underside of the construction above ceilings. These walls should be clearly identified.

Item 10 - Check floor and wall finish schedule with that of the floor plans and elevation to determine which areas will receive tile. Height of wall tile should also be shown. (Finish schedule occasionally is not consistent with what is called for in the floor plans and elevation.)

Item 11 - Plans and specifications should address which method of carpet installation ("tackless strip" method or "glue down" method) will be used.

DIVISION 10

SPECIALTIES

Item 1 - Structural drawings should include detail of wood backing and supports for wall or ceiling mounted items (often omitted or overlooked).

Item 2 - Items that project out from the wall in general, and grab bars in particular, should be mounted directly to the wall framing system or to the built-in anchorages attached to the framing system.

Item 3 - Check locations of chalkboards, tackboards, directory and bulletin boards, etc. They should be addressed in the plans and/or specifications.

Item 4 - Make sure that toilet partitions and urinal screens supported only on walls, or units supported on wall and overhead construction are not secured to plaster or gypsum board alone, but are secured to solid wood or steel backing material which is, in turn, secured to joists, studs or other structural elements of the framing system.

Item 5 - Mounting heights and locations of all toilet and bath accessories should be indicated in the plans. Verify also handicapped toilets and access route requirements.

Item 6 - Windows that will receive venetian or vertical blinds should be clearly identified in the plans and specifications.

Item 7 - Plans and specifications should include a suitable drapery schedule which includes information such as areas and rooms to receive draperies, size and placement of each, type and location of rod and track, type of fabric, etc.

DIVISION 11

EQUIPMENT

Item 1 - Verify location of equipment in building.

Item 2 - Check overall dimensions of equipment against size of room where scheduled to be located. Ensure door or window openings are large enough to permit access.

Item 3 - Verify electrical compatibility/capacity. Check responsibility for hook-up.

Item 4 - Verify plumbing capacity and responsibility for hook-up.

Item 5 - Check specifications for submission of Operation and Maintenance manuals and training of activity personnel under direction of manufacturer's representative.

Item 6 - Ensure proper ventilation and drainage is provided in accordance with equipment specifications.

Item 7 - Ensure proper warnings signs are specified for areas where high voltage, high noise level or other hazardous conditions exist.

Item 8 - If any hazardous materials are used/stored in area, ensure use/storage is in conformance with activity hazardous material handling procedures. Verify that the activity responsible for the local Spill Prevention Control and Countermeasures (SPCC) plan is made aware of the types and quantities of hazardous materials.

DIVISION 12

FURNISHINGS

Item 1 - Check furnishings covered by contract. Furnishings will usually be purchased and installed under separate GSA contracts (supply-type purchases).

Item 2 - For any items covered, verify location of furnishings with activity. Check size against room dimensions, door or window openings for access, ceiling height and location of fixtures. Check colors against finishes, carpeting, etc.

Item 3 - If furnishings are government furnished material (GFM), verify responsibility for procurement, delivery schedule, handling and storage requirements.

DIVISION 13

SPECIAL CONSTRUCTION

(This division is set aside for specialized construction which would not adequately be covered in another division. Normally, the work will be performed by specialists in the area. Such construction might include saunas, swimming pools, specialized laboratory facilities, solar collector facilities or any other construction which can be better detailed in this section. Some general considerations apply.)

Item 1 - Check electrical compatibility/capacity of any equipment specified. Verify responsibility for hook-up.

Item 2 - Check plumbing capacity for any equipment specified. Verify responsibility for hook-up.

Item 3 - Verify compatibility of new construction with existing buildings, if applicable.

Item 4 - Ensure specifications require any Operation and Maintenance manuals applicable to the facility be turned over to the contracting officer prior to contract completion and that proper training under direction of a manufacture's representative is provided for cognizant activity.

DIVISION 14

CONVEYING SYSTEMS

Item 1 - Verify location of conveying system (dumbwaiter, escalator, elevator, etc.). Check against architectural drawings.

Item 2 - Verify that structural openings designed to accommodate the system are consistent with overall dimensions of the equipment and related utilities.

Item 3 - Ensure that maintenance access panels are unobstructed and clearly identified.

Item 4 - Check specifications for inspection requirements by state/local/NAVFAC agencies.

Item 5 - Ensure the specifications require that Operation and Maintenance manuals are provided prior to the completion of the contract and that activity personnel are trained under the direction of a manufacutrer's representative.

Item 6 - Verify that the specifications require that operating instructions are to be properly posted if the conveying system will be used by the general public.

DIVISION 15

MECHANICAL

Item 1 - Verify all Mechanical and Plumbing notes.

Item 2 - Verify all air conditioning units, heaters and exhaust fans against architectural roof plans and mechanical schedules.

Item 3 - Verify HVAC floor plans against architectural drawings, especially for size.

Item 4 - Check requirements for balancing of HVAC system.

Item 5 - Verify that adequate ceiling height or attic space exists at major duct intersections.

Item 6 - Verify diffusers against architectural reflected ceiling plan.

Item 7 - Requirements for submission of any Operation and Maintenance manuals for major mechanical equipment should also be included in the specifications. Specifications should require the contractor to train operating personnel to operate the newly installed mechanical equipment (e.g., air conditioning system, boiler plant, etc.) under the direction of a manufacturer's representative.

Item 8 - Specifications should include a required period of operation before the equipment turnover to the owner.

Item 9 - Check specification requirement for necessary spare parts and tools to be provided by the contractor for all of the equipment.

Item 10 - Check major items of equipment and verify if they are coordinated with contract drawings. Pay particular attention to horsepower ratings and voltage requirements.

Item 11 - Check ceiling height and size of doors of areas where mechanical equipment (AHU, compressors, steam generators, etc.) will enter into the building to make sure that there will be enought space and passage for the equipment.

Item 12 - Floor drains should be provided for equipment blow-off.

Item 13 - Verify all roof penetrations (ducts, fans, etc. are indicated on roof plans.

Item 14 - Specifications should indicate who will perform the cutting and patching/repairs when installing equipment on existing buildings.

Item 15 - Provide access doors at all fire dampers, automatic dampers, coils, filters, heaters thermostats or at any item that requires servicing. Doors are to be airtight, securely fastened and accessible and able to be fully opened.

Item 16 - Verify fire dampers are indicated at smoke and fire walls

Item 17 - Specifications should indicate that all Fire Sprinkler System submittals will be subject to review and approval of the EFD Fire Protection Branch, coordinated with fire alarm specifications and Mechanical/Electrical drawings.

Item 18 - On existing buildings, check piping for possible interference with other existing utilities above ceiling and other parts of the building.

Item 19 - Check all connections.

Item 20 - Check requirements for hydrostatic testing.

Item 21 - Spacing of pipe hangers and supports for each type of pipe should be addressed in the plans and specifications.

Item 22 - Make certain that access panels are provided for valves located behind ceilings and walls.

Item 23 - Insure that in large structures, water service is such that portions of the system may be isolated for repairs without interrupting service in entire building.

Item 24 - Insure that roof drains are not going to be placed higher than surrounding roof. Verify discharge point. Cross-check against architectural drawing locations. If possible, verify that roof drains connect to storm sewer and not sanitary sewer lines.

Item 25 - Verify that all fixtures are connected to the sanitary system and that pipe sizes agree.

Item 26 - Gas lines should be above other utilities which cross or parallel.

Item 27 - Asbestos removal specifications should be included in the General Paragraphs if there is any asbestos on equipment or piping to be removed.

DIVISION 16

ELECTRICAL

Item 1 - Specifications should clearly define procedures and restrictions for scheduling outages and the feasibility of utility interruptions. Check against the statement made in the General Paragraphs for consistency, and that the two are cross-referenced.

Item 2 - Requirements for submission of Operation and Maintenance manuals for major electrical equipment should be included in the specifications. Specifications should require the contractor to train operating personnel to operate the newly installed electrical equipment/facilities (e.g., substation, motor control center, intercom system, fire alarm system, generators, etc.) under the direction of a manufaturer's representative.

Item 3 - Check major items of equipment and verify if they are coordinated with contract drawings. Pay particular attention to horsepower ratings and voltage requirements.

Item 4 - For major transformers and on primary circuit breakers, requirements for factory inspection

should be included in the plans and specifications.

Item 5 - Check ceiling height and size of doors of areas where electrical equipment (i.e. transformers, motor control center, etc.) will enter into the building to make sure that there will be enough space and passage for the equipment. Verify overall dimensions of electrical equipment (i.e. switchgear, transformers, etc.) to insure they will fit in the space provide.

Item 6 - Transformers shall have a minimum aisle space of 18 inches.

Item 7 - Insure that outdoor transformer pads have adequate drainage. Check also the area's susceptibility to flooding.

Item 8 - Provide general guidance on handling, removal, maintenance, etc. of transformers with Polychlorinated Biphenyls (PCB).

Item 9 - Verify if explosive/hazard areas are shown/defined.

Item 10 - Verify if building frame is to be grounded. Are equipment/computer grounds shown?

Item 11 - For underground electrical distributuion systems, check conduit for possible interference with other underground utilities.

Item 12 - Insure that the required depth of utility pole holes is shown in the plans and specifications for each type of pole and type of soil.

Item 13 - Proper sag of conductor between poles should be addressed in the plans and specifications.

Item 14 - Plans and specifications should clearly address connections between new and existing equipment.

Item 15 - Electrical power source for new and old buildings should be clearly shown and explained on the drawings.

Item 16 - Verify all Electrical drawing notes. Make sure they make sense when compared with other notes.

Item 17 - Verify sizes (diameter or thickness) of items supposed to be concealed in the wall to make sure they will not protrude beyond the face of the studs (i.e. electrical outlet boxes).

Item 18 - Verify location of all panel boards and that they are indicated on the electrical riser diagram.

Item 19 - Verify that there is sufficient space for all electrical panels to fit where specified.

Item 20 - On existing buildings, check conduits for possible interference with other existing utilities above the ceiling and other parts of the building.

Item 21 - Electrical switches should not be put partly within a tile wall and partly within a non-tile wall, especially in bathrooms.

Item 22 - Each lighting fixture should be detailed on the drawings to show shape, lamp, diffuser, finish and construction and mounting method, and gasketing and dimensions of poles for exterior lighting.

Item 23 - Plans and specifications should also indicate lighting fixture mounting heights and specific locations.

Item 24 - Verify all light fixtures against architectural reflected ceiling plan.

Item 25 - Specifications should indicate that all fire alarm system submittals will be subject for review and approval by the EFD Fire Protection Branch, coordinated with fire sprinkler system specifications and Mechanical/Electrical drawings.

Item 26 - Proposed fire alarm system should interface with existing alarm system.

DESIGN CONSTRUCTIBILITY REVIEW CHECKLIST

(to be used in conjunction with the guidelines)

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 00 - BIDDING INFORMATION				
1	Bidding place address correct of IFB				
2	Plan issue office address/phone no. correct				
3	Correct phone no./address for bid inquiries				
4	Correct phone no./times for pre-bid site visit				
5	General Description completely covers contract				
6	Proper forms included for contractor to indicate bid				
	DIVISION 01 - GENERAL REQUIREMENTS				
1	Check bid item wording/annotation on drawings				
2	Evaluate contract completion time				
3	Check scheduling/phasing with activity needs				
4	Check liquidated damages for multiple phases				
5	Verify contract no./drawing no./title are consistent				
6	For UPC, check Schedule of Prices form				
7	Is salvage material clearly identified?				
8	Is Construction Rep. field office required?				
9	Verify site conditions!				
10	Check type of progress schedule designated				
11	Check provisions/restrictions for utility outages				
12	Is GFE/GFM clearly identified?				
13	Check restrictions on access to construction site				
14	Check security requirements/passes				
15	Check reuqirements for local/state special permits				
16	Check clauses concerning restricted data				
17	Check requirements for CQC				
18	Ensure EPA requirements are clearly identified				

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 01 - GENERAL REQUIREMENTS (continued)				
19	Check experience clause requirements				
20	Verify types of bonds required				
21	Check for proper insurance clauses				
22	Check for statutory cost limitations				
23	Has contract been considered for small business				
	DIVISION 02 - SITE WORK				
1	Verify property line dimensions				
2	Do drawings clearly indicate clearing/grubbing limits				
3	Are horizontal/vertical survey monuments shown?				
4	Are underground utilities marked?				
5	Check fence line/grade for conflict with existing				
6	Verify new utilities connecting with existing				
7	Check that sewer lines are shown below water lines				
8	Are underground obstuctions clearly indicated?				
9	Are borrow/waste areas clearly marked?				
10	Have dump sites been indicated?				
11	Check availability of demolition site				
12	Is demolition worked to be phased?				
13	Verify number/location of Test Piles				
14	Do drawings include boring logs/soil class/GWL				
15	Is dewatering required?				
16	Check shoring/sheeting requirements				
17	Verify line/grade of ditches				
18	Check location and extent of pavements				
19	Check location of manholes/risers/etc to be installed				
20	Check thickness of pavements indicated				
21	Do specs provide for positive control of bitum mat'l				
22	Check test requirements for asphalt/aggregate/sand				
23	Verify landscaping requirements for site				
24	Can irrigation to new areas be provided in phases?				

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 02 - SITE WORK (continued)				
25	Check number of trees/shrubs against schedule				
26	Verify plantings will not interfere with utilities				
27	Check requirements for fertilizing				
28	Verify soil condition prior to planting				
29	Verify existing trees will be protected during const.				
30	Check with customer on trees/shrubs to be removed				
	DIVISION 03 - CONCRETE				
1	Review concrete mix design				
2	Check requirements to test cement				
3	Verify minimun days/strength required for form remov.				
4	Check that same cement used for each member is noted				
5	Is paving and jointing plan required				
6	Check minimum coverages for reinforcing steel				
7	Verify reinforcement is supported and wired				
8	Do drawings include rebar splicing details?				
9	Is type of finish specified?				
10	Is minimum curing time specified for CIP builtup roof				
11	Do specifications include tolerance levels?				
12	Are strand ends recessed for tensioning				
13	Do specs limit number of cut strands?				
14	Verify adherence to catalog guarantees				
15	Check requirements for prestressed shop drawings				
16	Verify slab finish elevations				
17	Verify perimeter slab matches architectural drawing				
18	Verify columns/beams against schedule				
19	Verify expansion joints throughout building				
20	Check building elevations/floor plans/sections				
21	Check wall sections against bldg sections/structural				

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 04 - MASONRY				
1	Do specifications require a sample of masonry?				
2	Is a full-time masonry inspector required?				
3	Verify masonry opening for windows/doors				
	DIVISION 05 - METALS				
1	Verify which materials are to be factory inspected				
2	Ensure structural steel connection details are shown				
3	Verify stud types/sizes/spacings				
4	Verify reqirements for welders				
5	Check miscellaneous metal itemS				
6	Verify structural members against column/beam sched				
7	Check column length against column schedule				
8	Verify roof framing column lines and columns				
9	Verify perimeter roof line against arch. roof plan				
10	Verify expansion joints throughout building				
	DIVISION 06 - WOOD WORK				
1	Check requirements for finish carpentry and mill work				
2	Check requirements for fastening finish carpenty				
3	Check restrictions on cuts for service runs				
4	Verify cabinets will fit				
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION				
1	Check roof inspection requirements				
2	Do specs indicated items required for test cut?				
3	Is pre-installation conference indicated?				
4	Verify which surfaces are to be dampproofed				
5	Verify acceptable range of moisture content				
6	Verify type of expansion joint's sealant mat'l				
7	Do specs indicate sealant coverage per lineal foot?				
8	Are items which penetrate membrane identified?				
9	Verify requirement for insulation to be kept dry				

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION (cont)				
10	Verify requirement for material to be properly store				
11	Verify requirement for glazed-coating				
12	Is rate of application of hot bitumen specified?				
13	Verify statement that no hot Kettles allowed on roof				
14	Check is local fire department needs notifying				
	DIVISION 08 - DOORS AND WINDOWS				
1	Verify building elevations concerning windows/doors				
2	Verify building sections noting window/door openings				
3	Verify door schedule				
4	Check door hardware schedule				
5	Check "Detail Numbers" against arch. drawings				
6	Verify measurements of doors/windows upon delivery				
7	Is storage/handling of doors/windows specified?				
8	Check glass/glazing specification				
9	Check temperature restrictions for glass/glazing				
10	Verify keying system with activity				
	DIVISION 09 - FINISHES				
1	Check finish schedule				
2	Check temp/ventilation requirements for plastering				
3	Verify surfaces requiring waxing/buffing				
4	Verify painting schedule				
5	Verify maximum/minimum paint coverages				
6	Check if patched areas are to be painted				
7	Verify areas to be plastered for fire prot/sound red.				
8	Verify fire rated walls are clearly indicated				
9	Verify where wall terminate (at ceiling or above)				
10	Check floor/wall finish schedule with floor plans				
11	Verify carpet installation method				

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 10 - SPECIALTIES				
1	Verify backing/support for wall/ceiling mounted items				
2	Verify anchorage for grab bars				
3	Check locations of chalkboards/bulletin boards/etc.				
4	Verify support for toilet partitions				
5	Check mounting heights of all bathroom fixtures				
6	Verify windows receiving blinds are clearly marked				
7	Check drapery schedule				
	DIVISION 11 - EQUIPMENT				
1	Verify location of equipment				
2	Check overall dimensions of equipment				
3	Verify electrical compatibility/capacity				
4	Verify plumbing capacity				
5	Check requirement for O&M manuals and training				
6	Check for proper ventilation and drainage for equip				
7	Ensure proper warning signs are specified				
8	Check for hazardous material usage/storage				
	DIVISION 14 - CONVEYING SYSTEMS				
1	Verify location of conveying system				
2	Verify structural openings against equip dimensions				
3	Ensure maint. access panels are clearly marked				
4	Check inspection requirements				
5	Check requirement for O&M manuals and training				
6	Check posting of operational information				
	DIVISION 15 - MECHANICAL				
1	Verify plumbing and mechanical notes				
2	Verify HVAC/exhaust fans against roof plans				
3	Verify HVAC floor plans against arch. drawings				
4	Verify ceiling height/clearance at duct intersections				

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 15 - MECHANICAL (continued)				
5	Verify diffusers against arch. reflected ceiling plan				
6	Check requirement for O&M manuals and trainaing				
7	Check requirement for a equipment turnover period				
8	Check requirements for spare parts/tools				
9	Check horsepower ratings/voltage requirements				
10	Check ceiling height/door openings for equipment				
11	Verify floor drains are provided where needed				
12	Verify roof penetrations are indicated				
13	Check responsibility for cutting/patching on bldg.				
14	Verify access doorsat fire dampers/coils/heaters/etc				
15	Verify fire dampers are indicated at smoke/fire walls				
16	Verify EFD fire protection requirements				
17	Check for interference between new/old piping				
18	Check spacing of pipe hangers/supports				
19	Ensure access panels are provided for valves in walls				
20	Verify water service can be sectioned for repairs				
21	Verify roof drains are below roof elevation				
22	Verify new fixtures connect to existing system				
23	Ensure gas lines are above other utilities				
24	Check for asbestos removal requirements				
	DIVISION 16 - ELECTRICAL				
1	Verify procedures/restrictions for power outages				
2	Check requirements for O&M manuals and training				
3	Check major items of equip/verify with contract draw				
4	Check requirements for factory insp of major items				
5	Check ceiling height/size of doors against equip size				
6	Verify transformers have minimum 18 inch aisle space				
7	Ensure outdoor transf. pads have drainage				
8	Check procedures for handling transf. with PCB's				
9	Verify explosive/hazard areas clearly indicated				
10	Verify is building frame is to be grounded				

ITEM	DESCRIPTION	YES	NO	N/A	REMARKS
	DIVISION 16 - ELECTRICAL (continued)				
11	Verify location of underground utilities				
12	Check required depth of utility poles				
13	Check for proper sag of conductor between poles				
14	Verify connections between new and existing equip				
15	Check electrical power source for new and exising bld				
16	Verify electrical drawing notes				
17	Verify sizes of items to be installed in walls				
18	Verify location of panel boards				
19	Ensure sufficient room exists for panels				
20	Check for conduit interference with existing bldg				
21	Verify elect. switches properly installed				
22	Check details on lighting fixtures				
23	Check lighting fixture mounting heights/locations				
24	Verify fixtures against arch. reflected ceiling plan				
25	Check requirements for EFD insp. of sprinkler system				
26	Verify that new fire alarm system interfaces w/ exist				

SECTION FIVE

RECOMMENDATIONS

The guidelines presented are the minimum considerations which should be checked prior to the advertisement of a contract. Verification of these items should significantly reduce the errors, omissions and ambiguities associated with contract discrepancies and greatly increase the quality of the product. Checklists provide a vehicle for the accomplishment of an adequate review which is thorough and timely. Guidelines and requirements from several sources are combined in a logical order to ensure that most conditions are considered and to reduce the time required to research each item separately.

The presentation of these guidelines could be significantly improved by developing a computer checklist program for use on a personal computer or whichever system is available to the contract office. The program would allow the user to input the CSI divisions applicable to a specific contract. The guidelines and associated checklists would be provided only for those areas of interest. There are a number of ways the user could interact with the program. One option would be to simply request a hardcopy of the guidelines and checklists for manual consideration of the items. A second option would allow the user to respond to each item and have that response entered into a checklist

response file. With that file completed, a variety of reports could be prepared depending on the information required. A list of each applicable item considered could be printed to document the review or a report of only those items where discrepancies were noted could be prepared for forwarding to the designer. Having the ability to present the information in a variety of formats reduces the repetitive processing of the remarks.

The CSI format greatly enhances the effectiveness of the review. It provides a built-in numbering system for the items to be considered and facilitates cross-referencing. Rather than simply grouping the guidelines into the broad CSI divisions, as presented in this report, the items could be numbered according to the Uniform Construction Index (UCI) cost analysis format. This format is based on CSI, but provides a more detailed breakdown of the categories. The user could interact with the program through a question/answer format. For each division applicable to a contract, the program would present items to be considered. A user response of "Not Applicable" would send the program to the next consideration. A response of "Yes" to an item would prompt additional considerations related to that item. For those items which the user responded with "No", a short remark would be requested by the program. The purpose of the review is to highlight those items which the reviewer finds questionable. On technical matters, a reviewer should

only note the possible discrepancy and not suggest a solution. The technical accuracy of the contract is the responsibility of the designer. Liability for the design could be placed on the reviewer if a suggested solution is implemented and later found to be in error.

Another feature of such a program would be expansion and refinement of the guidelines. With constant changes in contract law and regulations, especially in the federal sector, this feature would be a must. The guidelines could be updated and expanded as necessary and as the experience of the user increased. More detail and cross-referencing could be added to the guidelines. This could become too cumbersome in the present guideline format. The key to a sucessful review procedure is to make it thorough and efficient.

SECTION SIX

SUMMARY

Design constructibility reviews are an answer to the increasingly poor quality of contract documents and the associated increase in cost and delay in completion. The reviewer has a responsibility to his profession, the owner and the contractors bidding the job to present a document that is as free of errors, omissions and ambiguities as he can reasonably produce. While standardized reviews can be costly and time consuming, these drawbacks are offset by avoiding change orders after the contract has been awarded and the damage done. OICC Trident realized a dramatic decrease in the percentage of construction costs associated with change orders in the very first year of implementing the Redicheck system. This is one example of the benefits which can be realized by performing a methodical review. Although there is more potential for error on large projects, the small contracts can become very big headaches because they do not always get the same attention a large contract receives. A systematic review of all contract documents will reduce many of these problems.

The purpose of this report was to research guidelines to be used in a constructibility review and arrange them in a format which would facilitate the review. This has been accomplished manually. From this base of information

however, a computer program could be written to interact with a reviewer, providing only those guidelines which are pertinent to the specific contract. The information could be presented in a variety of formats without the usual repetitive work associated with preparing reports. Each step of the review is documented, including those items which were considered not applicable. The guidelines could be constantly refined and updated. Such a program would help reduce the time and effort required of an adequate review. A thorough, efficient method of review will benefit both the experienced reviewer and first-time reviewer, alike. The key to ensuring that adequate reviews are accomplished is to make them as easy as possible to use. Proper constructibility reviews will help keep projects on schedule and within budget, and will reduce contract problems for the project manager throughout the term of the contract.

APPENDIX ONE

RECORD OF INTERVIEWS

Phone Conversation with Mr. Stan Stanley, Chief of Quality Assurance, Corps of Engineers, Jacksonville, Florida

Key items: Every Corps of Engineers' project undergoes an extensive review by all parties involved in the project. Although reviews are done throughout the design of the project, the constructibility review is made at 100% design. The completed contract documents are distributed to the specification writers, technical specialists (i.e. geotechnical engineers, lakes and waterways division representatives, etc.) project manager and customer or agency involved. A "central review" is held where problems are highlighted and corrective action determined. The detail of this review is dependent on the size and complexity of the project. No specific guidelines are used in the review process as a checklist but rather the cognizant individuals are responsible for ensuring their area is covered. A feedback system is available within the organization for comment on the effectiveness or shortcomings of specific items occuring during the course of the job. This feedback is accomplished through the use of a locally published form, however actual use of this form has been minimal.

Phone Conversation with Mr. Vincent Spaulding, Code 022B - Contracts Quality Assurance Division, Naval Facilities Engineering Command

Key items: Contracts Quality Assurance (QA) Division was established in November 1985, in response to several audits and inspections which highlighted increased change orders and claims due to lack of established administrative quality control procedures. Responsible for pre-award, award and post-award administrative actions, this division has revised procedures; improved contract language to ensure the exact intent is stated; developed guidelines for documentation of contractor performance; determined training criteria for persons involved in quality assurance; and has generally coordinated all efforts in the area of contract quality assurance.

One major accomplishment of the division has been to implement a policy on the quality assurance of design by Architect-Engineer firms. Effective April 1986, the QC program used by an A-E firm is included as a selection evaluation factor. An interdisciplinary coordination review had been incorporated into the statement of work for an A-E contract. QC has been made a specific cost item in negotiating the A-E fee. Design firms are required to submit the coordination reviews along with the designs at the normal review intervals.

Mr. Spaulding will send copies of applicable notices and instructions.

Phone Conversation with Mr. William T. Nigro, Author of the Redi-Check System for Design Review

Key items: Mr. Nigro developed the Redi-Check system while serving in the Civil Engineer Corps, U.S. Navy. It is a standardized method for locating errors in contract plans. He has copywrited his procedure and is presently marketing it through his private consulting firm. In addtion to performing Redi-Checks as a consultant, Mr. Nigro offers one day training seminars on his system. His "selling" features for both the seminar and his services are the time and money saved the owner by having a more complete contract, and the decreased chances of liability claims for inaccurate contract documents. Mr. Nigro has published papers on the use of his system of review and the benefits realized. They have appeared in Engineering News Record and Architecture.

Interview with Mr. Frank Still, Construction Manager with Caudidet Roulet Scott - Sirene (CRSS) CM Firm

Key items: Mr. Still's current contract project is one phase of the addition to Shand's Hospital. Contract price is about $40 million. He spent 3 months reviewing the plans with the designers and preparing scopes of work for subcontracts. In performing review, he looks for changes to ease construction and scheduling. Original plans called for additional floors to be of concrete construction similar to existing. Mr. Still recommended structural steel to reduce weight and ease construction. His concern was also for

associated problems with concrete operations while meeting the hospital's requirements for access to construction areas and functional use of critical spaces in the immediate vicinity of the work. This required special consideration for quiet and cleanliness within the construction site. Mr. Still emphasized the importance of keeping the function of the activity in mind while reviewing the plans and specifications. "Constructibility vs. Safety vs. Liability" Items specifically noted: check column lines to see if they match existing; compare structural against architectural plans; write contracts to have subs check drawings prior to construction; identify errors and omissions ("designers hate those words, avoid using them"); and always check with activity on preliminary vs. final plans to ensure nothing has changed. With the type of contract he is working under, the CM has incentive to save money for the owner - it usually means less construction or simpler construction for the same fee. It is very important to develop a good working relationship with the designer. When project is completed, use as-builts to pick up mistakes for subsequent projects.

Phone Conversation with Mr. Lloyd Kelly, Project Manager, Gilbane (CM firm)

Key items: Gilbane is considered a large construction management firm. Backlog of dollar-volume is about $35 million company-wide. Total construction backlog is

approximately $1.16 billion. Review procedures depend on type of project. Constructibility review is performed by the estimating department using checklists. A "project executive" is responsible for the design phase coordination. He assists in the design development, coordinates the estimate and supervises any procurements until the project is ready for the construction management team. He then begins another project. The project executive is an experienced construction manager who deals exclusively with coordinating the pre-construction aspects of the project. Value engineering is utilized throughout the design phase, but it is most commonly applied when subcontractor bids come in over the estimate.

APPENDIX TWO

A. "Review of Plans and Specifications", excerpt from CHESNAVFACENGCOMINST 4330.62C, ROICC Contract Administration Handbook.

B. Section III Part 4 and Section IV Part 2, excerpts from NAVFAC P-68, Contracting Manual.

Dispersed Field Office Organization. In some cases, a particular OICC/ROICC may have functional cognizance over a large geographical area or remote construction sites. If this is the case, and there is more than one officer assigned to a particular OICC/ROICC, the designated AROICC at the satellite office under delegation of the OICC/ROICC may act as the OICC/ROICC in that particular area from an organizational standpoint, and all personnel assigned to that office will be in the configuration of a small OICC/ROICC office. Functional relationships and primary items to be considered in a position description are as indicated for the large or small OICC/ROICC organization depending on the workload volume.

In addition to the dispersed structure outlined above, a main or centralized OICC/ROICC office may have construction jobs dispersed over a large geographic area which do not demand establishing a full-time office at that location. In this case, inspectors periodically inspect and review the work of contractors at these varying locations and report to the particular cognizant Resident Engineer, AROICC or Project Engineer.

Procedures

Under authority of the Commander, Naval Facilities Engineering Command as Contracting Officer, each ROICC is assigned responsibility for his contract administration duties. Hereinafter are the detailed procedures to be followed by each ROICC in performing his duties. These procedures are arranged in the anticipated sequence of occurrence.

Review of Plans and Specifications

Policy and instruction governing plans and specifications are detailed in P-68, Paragraphs 3-401 through 3-413 and 4-200 through 4-225, and CHESNAVFACENGCOMINST 11012.5A. The ROICC should be aware of these provisions while reviewing plans and specifications prior to bid. In consonance with this regulation, it is essential to insure that designs meet user requirements and reflect current experience with regard to constructability. The functional review will take place at the 35% stage only. Normally, this is the last opportunity the customer/user/occupant has to effect a projects' design/facility parameters. Additionally, the project shall be reviewed at this time to determine if items which will constrain the execution of the construction have been considered. At the 35% review, two sets of documents are forwarded directly to the Public Works Officer (PWO) of the activity for whom the design is being accomplished. It is expected the PWO will furnish one set to the user/customer and will coordinate activity comments and their return directly to the Architect in Charge (AIC) or Engineer in Charge (EIC) at CHESNAVFACENGCOM.

The constructability review will be conducted at the 95%, or pre-final design stage. Four sets of review documents will be forwarded to the ROICC. Two sets of documents are forwarded by the ROICC to the PWO for his constructability review and comment. A total of two weeks (10 working days) is allowed in the design schedule for distribution, review and return of comments. The ROICC and staff will make a constructability review using the

other two sets. As a minimum, those items listed for review in Appendix A-1, are to be considered. Comments including constructability comments received from the PWO are to be returned to the CHESNAVFACENGCOM Design Division (Code 04) on the form (Appendix A-2) by the date requested. One copy of the comments is to be forwarded separately to Code 05. Code 04 will provide an explanation to the ROICC why any comments were not included in the subsequent bid documents. If no explanation is received, the ROICC should request the CHESNAVFACENGCOM Code 04 AIC or EIC why the comments were excluded.

ROICC's must sign the drawings prior to advertising. The ROICC signifies, by his signature, that he has performed the constructability review and his comments have been provided to CHESNAVFACENGCOM Code 04.

Inspection Plan

When plans and specifications are received by the ROICC for a constructability review, preparation of an inspection plan should be initiated. This plan is to be completed prior to the preconstruction meeting with the successful bidder. The plan should be developed by the construction representative who will be inspecting the work, with assistance from his supervisor and engineering staff as necessary. From the preconstruction meeting to the final inspection of the contract, the inspection plan is utilized and updated. The inspection plan will be based upon five elements:

1. A complete submittal log for shop drawings, catalog data, samples, certifications of compliance and test performance
2. Long lead time submittal items to be given attention at the preconstruction meeting
3. Milestone progress dates
4. Inspection and testing for work categorized by specification section
5. Establishment of a schedule which identifies the responsibility for inspection and test items outlined under the previous element.

With the data obtained through and by the development of the plan elements, a plan of action related to work progress can be established to ensure that timely, efficient and effective inspection effort is provided for the work. It should be emphasized, however, that, for any plan to be successful, it must be used, periodically and objectively evaluated and future actions rescheduled. The inspection plan is an organized list of "things to do" compiled during the review of the above elements.

Post Award A/E Services

Between bid opening and contract award, the ROICC, in consultation with the AIC or EIC and Code 09A2, will confirm that an A/E Post Award Service contract will be awarded and which shop drawing reviews, etc., will be done by the ROICC, the A/E or the EIC.

Pre-Bid Conference

A pre-bid conference will not normally be held for most projects. When

Constructability Review Considerations

1. Survey data, bench marks and triangulation points.
2. In-site construction area considerations.
3. Geotechnic data as boring logs, unusual soil or water table.
4. Verification of underground utilities and obstructions shown.
5. Demolition or removal requirements.
6. Storage area availability or restrictions.
7. Site restrictions or obstacles as avigation easements or abandoned trackage.
8. Surface drainage patterns.
9. Construction scheduling and work stoppage.
10. Available utilities for construction purposes.
11. Hazardous material handling debris removal and salvage.
12. Restrictions and scheduling of utility outages.
13. Security, routing, parking restrictions.
14. Necessity for construction signs, fences.
15. Additional requirements (passes, parking, haul route, occupied spaces, access to facilities).
16. Schedule work stoppages (June week activities, etc.).
17. Necessity for an inspector's office.
18. Possible Value Engineering cost savings to Government.
19. Perform extensive review of Division One of the Specification.
20. Check reasonableness of liquidated damages (Refer to P-68, 4-211).
21. Check reasonableness of completion time, seasonality of specified work
22. Insure that the responsibility for submittal approval is clearly indicated.
23. Insure that the responsibility and procedure for all material and equipment testing is clearly indicated.
24. Insure that any landscaping requirements for the planting season are commensurate with contract duration.
25. Insure that the project has received environmental protection safeguards with respect to dust control, erosion and disposal of wastes.
26. Check to see if cathodic protection has been included, if necessary.
27. Comment on any observed conflict between the plans and specifications, or between various disciplines, e.g., electrical and mechanical; HVAC ducts and structural members; between structural details and architectural features.
28. Provisions for start up; and operating and maintenance training on complex equipment.
29. Possible proprietary specification not indicated as such.
30. Identify design features of the contract which are related to hazards to personnel, equipment, materials and the environment.
31. Review for completeness of shop drawing and catalog data submittals, and determination of which are to be reserved for Government approval.

Part 4. Technical Specifications and Drawings (FAR PART 10 and 36.202)

3-401 GENERAL. Drawings and specifications provide the technical details for the facility that is to be provided. In order that a thoroughly complete and correct design, including a comprehensive review can be made, the preparation of drawings and specifications, whether by a field activity, in this Command, or by an A-E contractor, shall be initiated as far in advance of actual construction as planning, financing, and workload will permit. Command engineers and architects authorized to approve engineering drawings and specifications or to sign letters dealing with engineering decisions or documents that may be involved in change orders or claim cases, shall be restricted to those registered as professional engineers or architects. In the preparation of drawings and specifications, all applicable military and Command standards shall be strictly adhered to, unless directed otherwise, and all provisions of NAVFAC DM-6.1 and 6.2 shall be fully complied with. Technical portions of specifications should not include general contractual provisions such as experience clauses, requirements for supervisory erectors, etc. Legal and Administrative provisions should not be included in the technical portions or specifications.

3-402 CLARITY. It is essential that specifications be definite and explicit to assure a clear basis for bids and to obviate misunderstanding during the performance of the contract. The importance of an adequate specification cannot be overemphasized. The elimination of discrepancies and ambiguities from the project specifications will result in favorable bids, result in better contractor relationships, effect overall economies, and reduce disputes for extra compensation.

3-403 PERFORMANCE SPECIFICATIONS. (Purchase Description) (FAR 10.004) In some instances a performance specification may be more appropriate for use than descriptive specifications. Generally a performance specification indicates the required results, verifiable as meeting stipulated criteria, and free of unnecessary process limitations. Requirements such as fire endurance, toxicity, strength, durability and system output are stipulated. Performance specifications shall not be written so as to specify a product or a particular feature of a product proprietary to one manufacturer unless Level I Contracting Officer approval has been obtained. (See 3-405)

3-404 "OR EQUAL" SPECIFICATIONS. (FAR 10.004) Specifying items by naming acceptable commercial products followed by the words "or equal" is permitted under the following conditions: (a) there are no industry or Government-type specifications for the item, (b) the item is a minor part of the work, (c) the item cannot adequately be described because of its technically involved construction or composition. In each instance a minimum of three manufacturers shall be included in the description followed by the words "or equal." The essential features of the item must also be set forth in sufficient detail to establish the basis upon which the equality of nonlisted products will be determined.

3-405 PROPRIETARY SPECIFICATIONS. (FAR 10.002 and 36.202) Proprietary or restrictive requirements shall not be used unless it is established conclusively that no substitute will serve the purpose. Specifications shall be written to permit bidding by any supplier whose equipment provides the functional, technical, and physical requirements of the project. Proprietary requirements shall not be included in specifications without a Level I, Contracting Officer approval, who shall document the basis of his/her decision in the official contract file (D&F format apropriate). This requirement also applies to specifications prepared by others agencies for projects to be constructed by NAVFAC. In order to negate clauses such as "Material and Workmanship" and "Brand Name or Equal", when specification of a proprietary item has been authorized, the specification must state: "Notwithstanding any other provision of this contract, no other product will be acceptable".

3-405.1 Qualified Products. (FAR 9.2) The limitations pertaining to proprietary specifications do not apply to items on a qualified products list. However, such lists must be established and used in strict accordance with FAR 9.2 provisions.

3-406 COORDINATION OF SPECIFICATIONS AND OF SPECIFICATIONS WITH DRAWINGS. Many disputes arise over the lack of coordination of details contained in different specification sections (e.g., electrical and mechanical) and differences between the specifications and drawings. Extra care is required to assure that various sections of the contract are not in conflict with each other or that items or criteria have not been omitted on the assumption that they are included in another section.

3-407 REFERENCED SPECIFICATIONS. It is standard practice in construction contracts to incorporate by reference many military and commercial specifications. Many of these specifications include various options or alternates. Care must be taken to clearly identify which (if any) of these options or alternates are applicable.

3-408 COMMERCIAL SPECIFICATIONS. (FAR 36.202) In construction contracts standard commercial industry specifications shall be used to the maximum extent possible.

3-409 COLLATERAL EQUIPMENT. Collateral equipment that is not built into structures and can be removed and used elsewhere, such as bunks, furniture, lockers, portable file cabinets, mess gear, and loose galley equipment shall not be procured under construction contracts unless specifically approved by NAVFACENGCOM. Collateral equipment that is built into the structure, such as shelving, or that requires physical connections, such as ranges, may be included in construction contracts.

3-410 FOREIGN PRODUCTS. (See Section II, Part 3)

3-411 EXPERIENCE CLAUSES. Experience clauses shall not be included in the body of technical specifications. (See 4-202)

3-412 DREDGING CONTRACTS. Specifications for dredging must afford the bidder the opportunity to submit a bid based on accomplishing the required dredging and disposal by the most economical means available to the bidder (and satisfactory to the Government). Specifications shall advise bidders of all available disposal locations, which may be located with reasonable efforts. Local municipalities and State offices should be contacted to determine their interest in the spoil.

3-413 CONTRACTOR QUALITY PROVISIONS. Contracts that are subject to Contractor Quality Control (CQC) must include, in the technical portions of the specifications, a clear and accurate description of the tests the contractor is required to perform in various phases of the work.

Part 2. Specification Provisions, Division One

4-201 GENERAL. Division One of the specifications includes administrative as opposed to technical requirements which are included in other divisions. For construction, the content and organization of Division One is set forth in type specifications issued by NAVFACENGCOM Engineering and Design Division (Code 04). In addition to general administrative terms, this portion of the specification is used to include clauses that require filling in blanks by Government personnel during IFB preparation, such as liquidated damages and completion provisions. However, Division One is not to include bidding information or contract general provisions, or changes thereto. The adequacy and accuracy of the information included in Division One of the specification, as well as the information included in the bidding information and contract provision portions of the IFB, are the joint responsibilities of personnel in the contract division, engineering and design division, and construction division.

4-202 BID ITEMS.

4-202.1 General.

(a) The ideal number of bid items is one since additional items tend to cause bid errors, protests and similar problems. More than one bid item may be used to obtain more than one price when necessary to assure that award can be made within the funds available. A specification shall not include bid items solely for the purpose of obtaining price information.

(b) The drawings and specifications shall be developed and arranged so that Bid Item 1 covers work that can reasonably be expected to be procured within the funds available. Additional bid items may be provided if they are necessary to allow for vagaries in estimating or unit price items for dredging and excavation. When more than one bid item is used, all bid items shall be composed in the same manner, either by the successive addition of work or by the successive omission of work. Specification shall not include bid items for both added and omitted work. Each bid item shall be composed so that an award on any item, or combination of items, will provide a functionally complete and usable facility.

(c) The use of large number of bid items substantially increases the probability that errors will be encountered in the submission of bids. It is recognized that in certain types of maintenance service contracts a detailed schedule of deductions is necessary for orderly contract administration. However, it must also be acknowledged that facility support contracts fall into two major categories:

(i) Firm Fixed Price. Based on repetitive occurrences of work items, i.e., definite work items occurring daily, weekly, monthly, semi-annually, etc. Payment for such services is based primarily on the ratio of the passage of time to the total contract price. In such circumstances a single bid item is appropriate for bidding purposes. Normally a schedule of the repetitive services detailing the frequencies of occurrences is also included in the specifications. Said schedule when completed by the contractor forms the basis of deductions for non-performance or unsatisfactory performance pursuant to the Consequences of Contractors Failure to Perform the Required Services Clause of the contract. In these cases the specifications shall clearly describe the schedule of services as the Schedule of Deductions and indicate "that the Schedule of Deductions is to be provided within 15 days after award".

In the event the contractor fails to provide the Schedule of Deductions within 15 days allocated or submits a Schedule which is unbalanced, the Contracting Officer may terminate the contract for default or unilaterally establish a Schedule of Deductions for the contract term.

(ii) Indefinite Quantity Contracts. This is a fixed unit price contract form which does not specify the total amount of work which the Government will require, or when particular services will be required. Normally a schedule of work items with estimated quantities are prepared for bidding, in order to provide contractors a reasonable basis for estimating costs. This schedule of work items and estimated quantities will be included in the Invitation, Bid and Award package. Unit prices for each item on the schedule must be provided as part of the contractor's bid at time of bid opening. Low bidder to be determined on the basis of the low aggregate price for all bid items. IFB shall clearly state that the bid unit prices will be used as the basis for deduction in accordance with the Consequences of Contractors Failure to Provide Required Services clause of the contract.

4-202.2 Alternates. Bid items for alternates are not permitted. If the Commander considers the use of alternates essential, a request with full details shall be submitted to NAVFACENGCOM for approval. If alternate items are approved, special provisions concerning determination of the low bidder will be provided by NAVFACENGCOM. Alternates offered by bidders, for which no provision is contained in the bidding items, normally cannot be considered. (As used in this paragraph, an alternate bid is: "price for concrete parking $____; price for asphalt parking $____"). Specifications may include alternate provisions to be accomplished at the contractor's option but this option will not be priced separately.

4-202.3 Additive or Deductive Items. (DFAR 36.303(70))

(a) When it appears that funds available for a project may be insufficient for all the desired features of a construction project, provide a first (base bid) item covering the major portion of the work and one or more additive bid items which independently add specified (not needed to have a usable facility) features of work in order of priority (most important first). The low bidder and the bid items to be awarded shall be determined as provided in paragraph 21, Instructions to Bidders. The specification section on bids shall reference this paragraph. Prior to the opening of bids, record in the contract file the control amount for the project. (See 3-502) The amount so recorded shall be controlling for determining the low bidder.

(b) Each bid item must be independent so that award may be made on any combination of items. (e.g., item 2 cannot be "addition to a porch" and item 3 "screening for porch" since award could not be made on the base item and item 3 alone.)

(c) Item 1 shall be specifically identified as the base item. No more than four additional items shall be used without specific approval of the Contracting Officer.

(d) If all bids exceed the control amount additional funds may be added to reach the lowest base bid price received. Award (including further addition of funds) shall then be made as provided by the clause.

(e) These provisions make the determination of low bidder purely mechanical and eliminate the possibility of "picking and choosing" by manipulation of funds. After the low bidder is established, however, it is permissible to obtain additional funds and to make award on a different combination of items if the established low bidder is also low on this combination.

(f) No combination of additive/deductive or other bidding systems (e.g., unit prices and additive items) shall be used without prior approval of Level I Contracting Officer.

(g) Deductive Bid Items. Deductive bid items will not be used without authorization by a Level I Contracting Officer. Such authorization will be given only in specific exceptional cases. Under the deductive bid system, bid item 1 (the base item) shall cover the entire work specified. The OICC may include from one to four additional independent deductive items (listed in order of priority with the least desirable feature first) for severable features which are not essential to provide a useable facility These deductive items and the order of priority shall be agreed upon by the OICC and the sponsor. As a minimum, the Base Bid Item less all deductive items should fall within the Government estimate. Each deductive item shall be the amount to be deducted from Bid Item 1 for the deleted work covered by that item. The "Additive or Deductive Items" clause shall be deleted from the "Instructions to Bidders" (construction contract)" and the following substituted:

> "The low bidder for purposes of award shall be the conforming responsible bidder offering the low aggregate amount of Bid Item 1 (the base item) less, in the order of priority listed, the items necessary to permit award of the contract within the funds determined by the Government (before bids are opened) to be available. For example, if the amount of funds available is $100,000 and the low bidder's base bid and successive deductive items are $120,000, $8,000, $10,000, $6,000 and $4,000; the aggregate amount of the bid for purposes of award would be $96,000, the base bid minus the first, second and third deductive bid items. The fourth deductive would not be considered since the third deductive permits award within the funds available. After determination of the low bidder as stated, award in the best interests of the Government may be made on the base bid and any combination of deductive bids for which funds are determined to be available at the time of award, provided that award on such combination of bid items does not exceed the amount offered by any other conforming responsible bidder for the same combination of bid items."

4-202.4 Unit-Price Bid Items.

(a) For dredging, earthwork, repairs, and other types of projects where the exact quantities of work and materials cannot be practically determined prior to performance, the use of unit-price bid items is appropriate. When the bid items are unit prices, a quantity to be used for evaluation of bids must be stated for each item. This quantity must be the best possible estimate of the amount that actually will be required. The specification shall also provide that the unit price will be used to adjust the contract price for any increase or decrease in quantities, subject to the provisions of the variation in quantities clause (which shall be included in the contract).

(b) Subject to 4-202.3(f), combined lump sum unit price bids may be taken where construction involves pile driving, dredging, etc. In this case bids shall be:

#1 (a) price for all work except dredging = $________

#1 (b) price per yard for dredging 50,000 yards:
$________/yd x 50,000 = $________

Total price item #1 = $________

(c) Specifications providing for unit price bids shall include a provision stating; "In the event there is a difference between a unit price and the extended total, the unit price will be held to be the intended bid and the total recomputed accordingly. If a bidder provides a total but fails to enter a unit price, the total divided by the specified quantity will be held to be the intended unit price."

4-202.5 Bid for Services of Supervising Erector. (DFAR 37.7002) If a supply specification requires the services of a supervisory erector to be provided to the contractor doing construction, a bid item setting an amount per estimated working days shall be included in accordance with the unit price provisions above.

4-202.6 Special Types of Bidding

(a) Split Awards. When the work contemplated by the specification is of such a nature that it could be performed under two or more contracts, and it is considered that economies to the Government could result by permitting bids on all or a portion of the work, the bid items may provide for split award, with Contracting Officer approval. For example:

Item 1. The price for the entire work (two buildings and site improvements) complete, in accordance with the specifications and drawings.

Item 2. The price for the construction of building A and site work east of route 10, complete and in accordance with the specifications and drawings.

Item 3. The price for the construction of building B and site work west of route 10, complete and in accordance with the specifications and drawings.

In the above example, if an award is made, it will be on Item 1 or separately on Items 2 and 3, whichever results in the lowest total price. When such bid items are used, no further bid items shall be included and the specifications shall include:

> "Subject to the availability of funds, award will be made on bid item 1 or items 2 and 3 depending on which will result in the lowest total price to the Government. If funding does not permit an award for all of the work, award may be made on either item 2 or item 3 at the discretion of the Government."

When a split award is possible, the specifications shall include separate completion dates and, for construction, liquidated damages for each item upon which award may be made.

(b) Special Items. Special bidding procedures may be issued by NAVFACENGCOM to meet unusual circumstances (e.g., bid items for UEPH). These items will not be altered or used for other purposes without Level I Contracting Officer approval.

4-203 EXPERIENCE CLAUSES.

4-203.1 Contractor Experience. (FAR 9-104-1(b) and 19-602.)

(a) On occasion, because of special difficulties in the work, strict construction schedules, or past unsuccessful experience with contractors, the inclusion of a "Contractor Experience" requirement in the Invitation For Bids may provide a solution. Such a clause requires, as a precondition for award, that the low bidder (after bid opening) submit data to show that there will be a minimum quantum of skilled personnel, facilities, equipment, or experience necessary to complete the work. However, a long line of Comptroller General Decisions has unanimously held that such experience clauses relate to the responsibility of a firm, and more specifically, to its capacity to perform the work. The Comptroller General has further ruled, as required by the Small Business Act, 15 U.S.C. 637(b)(7), that when the firm is a small business, regardless of whether a small business set aside is involved, and regardless of the criticality of the contract, that the departments have no authority to reject such a firm unless the Small Business Administration (SBA) refuses to issue a Certificate of Competency. By statute the SBA determination is conclusive. In determining whether or not to issue a Certificate of Competency, the SBA is not bound to the experience clause provisions.

(b) In view of the limited practical value of experience clauses, together with the difficulty of writing any meaningful experience requirements, no experience clause may be included in any Invitation For Bids without specific Level I, Contracting Officer approval.

4-203.2 Equipment. In some instances, it may be appropriate to require that equipment to be furnished under a contract have prior proven performance. For such clauses to be effective, the equipment to be furnished under the contract would have to be absolutely identical in all respects with the equipment which had such prior proven performance. These provisions have a disadvantage in that they deprive the Navy of the benefits of any technical advances which have occurred since the equipment which has performed was produced. Level I, Contracting Officer approval of any equipment experience clauses must be obtained in advance of issuance of the solicitation.

4-204 DATA WITH BIDS. Except for bid bonds, representations and certifications and statutory cost information, the specifications shall not require the bidders to furnish with the bids any data whatsoever. The specifications may require data to be submitted by the low bidder after bid opening and prior to award.

4-205 BONDS. (FAR Part 28; also P-68 7-102).

4-205.1 Definition of Bonds.

(a) Bid Bond. A bid bond is a bond accompanying a bid in which the bidder and the surety obligate themselves, subject to forfeiture of the penal sum stated (20 percent of the bid price), that the bidder shall (a) undertake the performance of the contract and (b) shall furnish the performance and payment bonds required by the contract specifications.

(b) Performance Bonds. A performance bond covers the performance and fulfillment of all the undertakings, covenants, and terms, conditions, and agreements contained in the contract.

(c) Payment Bond. A payment bond secures the payment of all persons that supply labor and material in the prosecution of the work provided for in the contract.

4-205.2 Bonds for Construction. For each construction contract in excess of $25,000, a bid guarantee and performance and payment bonds shall be obtained. A notice of award of the contract shall be sent to the contractor by certified mail (return receipt requested) directing the contractor to furnish the required performance and payment bonds on the blank bond forms enclosed, within ten days after receipt of the letter. Under no circumstances shall a contractor be permitted to start work until required bonds have been received by the OICC. No payment of any sort shall be made to the contractor until required bonds have been received. If the bonds have not been received by the OICC within the time designated in the certified letter, the contractor shall be advised by telegram that failure to furnish the bonds within five days will require the OICC to recommend that the contract be terminated for default and the contractor held liable for any excess costs to complete. (See 7-102)

4-205.3 Verification. A verifax or other facsimile copy of the agent's authority to sign for the surety company is required as evidence of such authority. This requirement is included in the instructions to bidders for construction. When bonds are required for other than construction include the following in the Instructions to Bidders:

> "The bid guaranty bond shall be accompanied by a verifax or other facsimile copy of the agent's authority to sign bonds for the surety company."

4-205.4 Overseas Contracts. (2-311)

4-205.5 Bonds for Contracts Other Than Construction. (FAR 28-103)

(a) Normally bid, payment, and performance bonds will not be required for other than construction contracts. In unusual circumstances as described in FAR 28.103-2, EFD Commanders may require bid, performance, and payment bonds for janitorial and maintenance service contracts.

(b) Bid, performance, and payment bonds will not be required for maintenance service contracts estimated to be at a price of less than $100,000 or for any contracts, other than construction, awarded pursuant to Section 8(a) of the Small Business Act.

(c) Whenever a performance bond is required, a bid guarantee is also to be required. Payment bonds are to be required under circumstances as set forth in FAR 28.103-3, and must be on SF 1416. SF 25A is only authorized for use in conjunction with construction contracts.

(d) Whenever bonds are required in connection with contracts, other than construction contracts, the contract file should contain a statement of the reasons therefor, which must show that the requirements of FAR 28.103-2 have been met.

(e) When bonds are required for other than construction, it usually is appropriate to reduce the bonded amount to 10 percent to 25 percent of the contract price.

(f) See 4-206.3

4-205.6 Annual Bid Bonds. Annual bid bonds are frequently used by large companies selling large quantities of supplies and services to the U.S. Government. Annual bid bonds are not acceptable for construction contracts. For other than construction, bids may be considered when, in lieu of a bond, the bidder includes a statement that an annual bid bond is on file with a government agency and specifically identifies the location of the agency and the office holding the bond. The OICC must ascertain that the bond is on file, that it is valid, and that it is in an amount adequate to cover the contract, and that there are no restrictions in connection with the bond which would preclude it being applied to the instant contract. If it is determined that a valid bid bond is on file, the OICC may proceed as if a valid bid bond had been submitted.

4-206 SUBCONTRACTING ANTI-BROKERAGE PROVISION. (FAR 36.501) The clause set forth in FAR 36.501 shall be included in any construction contract estimated to exceed $1,000,000.00. The required percentage to be placed in the clause shall be the maximum consistent with the customary or necessary specialty subcontracting, complexity, and magnitude of the work, and shall not, under any circumstances, be less than 20 percent (15 percent in Armed Forces Housing contracts). The OICC may increase the required percentage up to 35 percent as deemed appropriate in the light of the nature of the work.

4-207 HALF-SIZE DRAWINGS.

(a) When half-size drawings are issued with the IFB, the following shall be included in the paragraph entitled "Drawings accompanying specifications" of the specifications: "The drawings included with this specification are half-size. Full-size drawings are available at the bidder's expense. Information for obtaining full-size drawings may be obtained from the OICC. Full-size drawings may be inspected during regular working hours at the office of the OICC." Arrangements shall be made with reproduction agencies to make full-size reproductions of construction drawings available to bidders at their expense.

(b) The specifications shall provide that, after award of contract, up to fifteen sets of full-size prints will be issued to the contractor at no cost. Additional requirements, above this number, will be at the contractor's expense. (See FAR 36.571-3)

4-208 ASSUMPTION OF RISK. In some instances, bidders on construction work to be performed at or near naval ammunition depots or magazines have experienced difficulty in obtaining builder's risk insurance at other than excessive rates. Such excessive insurance rates are reflected in higher bid prices. Therefore, where it is deemed warranted, Commanders may authorize the following clause to be added when work is to be performed in proximity to such areas:

> Limited Assumption of Risk by Government.
>
> (a) Title of all work in place shall be in the Government, and title to all property intended for incorporation in the work shall vest in the government upon delivery thereof to the site of the work. The term "Government-owned property" as used in this article refers to such work in place and to such other property as to which title has vested in the Government pursuant to the provisions of the preceding sentence and likewise includes any property furnished or rented to the contractor by the Government. Upon completion of the work, any such Government-owned property not a part of the work (except property rented to, or furnished without charge to the contractor by the Government) shall become the property of the contractor. The vesting of title in the Government, as provided in this paragraph, shall in no way relieve the contractor of any obligations otherwise provided in this contract in respect to such Government-owned property except as expressly stated in paragraph (b) of this article.

(b) The contractor represents that the contract price does not include the cost of insurance, nor any provision for a reserve, covering the risk assumed by the Government under this paragraph. The Government assumes the risk of loss or damage to such Government-owned property (including expenses incidental to such loss or damage) which results directly or indirectly from the explosion of Government-owned or controlled munitions (including, without limitations, ammunition, bombs, powder, dynamite and other explosives), whether or not caused by negligence, except that the Government does not assume at any time the risk of, and the contractor shall be responsible for, such loss or damage (1) which is in fact covered by insurance or for which contractor is otherwise reimbursed, or (2) which is disregard of proper instructions of the Contracting Officer, on the part of any of the contractor's directors, officers or any other representatives having supervision or direction of all or substantially all the contractor's operations under this contract.

(c) In the event of loss or damage to Government-owned property resulting from the risk assumed by the Government hereunder, the Contracting Officer shall determine whether and to what extent, such property shall be rebuilt, repaired or replaced by the contractor or otherwise. Should this determination cause an increase or decrease in the cost of doing the work under this contract or time required for its performance, an equitable adjustment in the pertinent contract terms shall be made in the manner and upon notice as provided in Clause 3, Changes, of the NAVFACENGCOM General Provisions for Construction Contracts.

(d) The provisions of Clause 12, Permits and Responsibilities, of the General Provisions, are to be deemed modified by this article only to the extent required to give effect to the limited assumption of risk herein before in this article provided.

4-209 INSURANCE.

4-209.1 Work on Base. (FAR 28.307-2) Insurance provisions applicable to construction work on a Government installation are included in the standard forms. If other contracts require the contractors to perform work on a Government installation, the OICC shall assure that proper insurance clauses are included. NAVFACENGCOM contracts requiring operation on Government property shall specify insurance coverage as required by state and local laws or by FAR 28-306-7, whichever necessitates a higher coverage.EFD commanders are authorized to specify higher coverages, when justified, on a case-by-case basis. When higher coverages are required, NAVFACENGCOM should be advised in writing of the limits used and justification therefore to permit periodic review of the adequacy of the minimum.

4-209.2 Overseas Contracts. See 2-307.

4-209.3 Insurance on Equipment and Materials. Normally, the U.S. Government acts as a self insurer. When the Contracting Officer considers that there may be dealings with unusual circumstances, which warrant requiring the contractor to take out special insurance as protection from unusual losses, the matter shall be referred to NAVFACENGCOM.

4-210 OPTIONS. (FAR 17.2)

4-210.1 General. Option provisions provide a useful vehicle for obtaining additional supplies or services without resolicitation. However, the use of options should be carefully considered. The inclusion of an option provision frequently results in higher prices for the initial quantity, if the option quantity must be at the same unit price, since the contractor must include a factor for contingencies or cannot be assured of spreading start-up or engineering costs over the full quantity of items. On the other hand, permitting different prices for option quantities creates the opportunity for exorbitant option item prices unless those prices are also considered in bid evaluation. Such evaluation requires approval prior to issuance of the Invitation For Bid (IFB) by NAVFACENGCOM HQ (see FAR 17.203).

4-210.2 Supply Contracts. Options for not to exceed 50 percent of the basic quantity and at the same unit price as the basic quantity, may be used without NAVFACENGCOM approval. Options for quantities greater than 50 percent, or options which do not require that option quantities be at the same unit price as the basic quantities, must be approved by NAVFACENGCOM.

4-210.3 Service Contracts.

(a) Service contracts may include options to extend the contract so as to continue performance through, but not beyond, the fifth anniversary of the date of commencement of performance (for example, one year with four additional option periods of one year each). Neither the base period nor any option period shall exceed one year.

(b) The appropriate clause in FAR 22.1006 must be included in any contract which contains an option to extend and which is subject to the Service Contract Act.

(c) If a service contractor is subject to substantial cost increases not covered by the clauses in FAR 22.1006, options should be limited to no more than one additional year, or in extreme cases not used at all, in order to avoid undue financial hardships.

(d) NAVFACENGCOM approval is not required to include options in service contracts if the unit price is the same throughout the entire contract term except for FAR 22.1006 adjustments.

(e) See 9-107.

4-210.4 Construction.

(a) Because of Davis-Bacon limitations, options to extend performance period are not to be used in maintenance construction contracts. See 9-105.1.

(b) Options to add specific work to a basic scope of any construction contract may be used only with presolicitation NAVFACENGCOM approval. This approval will only be given if all conditions set forth in FAR 17.206 are satisfied. In such cases, the option work will be described in detail in the plans and specifications and the IFB and the evaluation will comply with FAR 14.201-6 and 17.208.

4-210.5 Lease Agreements with Options to Buy. Leases for equipment and other commodities may include an option to buy. This provision shall be drafted so as to preclude the Government's payment to a contractor of more than the fair market value of an item obtained through a lease agreement. Note that O&M funds are not available to exercise a purchase option in excess of $1,000. (See 3-103)

4-210.6 Contractor Options. A contractor's option exists when the specification permits a choice of material, design, or method. The right to select an option rests with the contractor. The specification shall not require bidders to identify the option they intend to select. After the bid opening, the OICC may require the contractor to state the options that are intended to be exercised. But this shall not prohibit the contractor from changing the election if so desired.

4-211 COMPLETION DATES.

4-211.1 Time of Performance. (FAR 12.102(b)) In establishing the completion date of a contract the contracting officer shall give due consideration to:

(a) the complexity of the project;

(b) the construction seasons involved;

(c) the date by which the work is required; and

(d) the capacity of the contractors to perform.

If the completion date is unreasonably short, bidders may simply increase their bids by the amount of liquidated damages. In the IFB, completion dates shall be stated in calendar days (e.g., 180 calendar days) and not specific dates.

4-211.2 Establishing the Completion Date. The ASBCA has held that contractors must be given a reasonable time to submit their bonds before the contract time starts to run. Accordingly, when bonds are required, the contract completion date shall be computed starting 15 calendar days after notice of award (5 days for mailing and 10 days to furnish bonds.) The following shall be added to the completion date provisions of all contracts requiring the contractor to submit bonds:

> "The contract completion date will be computed starting 15 calendar days after the date of award. This 15 day period is to allow for mailing of the notice of award and the contractor's submission of the required bonds."

4-211.3 Multiple Completion Dates. (FAR 12.102(b)(6)) Multiple completion dates may used when elements of the work are readily separable. This may prevent delays and/or time extensions for completion of an entire project when excusable delays or changes affect only a separable portion thereof. Where such dates are shown, requests for extensions of time for delays must be evaluated with respect to each item and the affected completion dates modified where appropriate.

4-211.4 Overtime. (FAR 22.103)

(a) OICC's shall assure that contract completion dates are normally set so as not to require work in excess of eight hours per day and 40 hours per week for timely completion. When necessary, fixed price contracts requiring work in excess of eight hours per day or 40 hours per week, may be issued if justified pursuant to the following procedures:

(1) When, prior to advertisement, work in excess of eight hours per day or 40 hours per week is considered necessary to meet a delivery or performance schedule, Commanders shall assure that the using activity is furnished the following information:

(A) estimated number of overtime hours required;

(B) estimated cost of premium pay resulting from the required overtime or extra-pay shifts (it should be made clear that this figure is premium pay only and does not include straight time pay for the overtime hours);

(C) period during which overtime or extra-pay shifts will be required; and

(D) time anticipated to be required for accomplishment of the entire contract work;

(2) The using activity shall be requested to certify, in writing, that the delivery or performance schedule is essential.

(3) On receipt of the certification of the using activity the OICC may issue bidding documents with a completion date that will require the contractor to work overtime.

4-212 LIQUIDATED DAMAGES. (FAR 12.2 and 36.206) A liquidated damages clause shall be included in all construction contracts in excess of $25,000 except cost-plus-fixed-fee contracts or those where the contractor cannot control the pace of the work. Use of a liquidated damages clause is optional for contracts of $25,000 or less and contracts for work other than construction. Where such a provision is used the clause set forth in FAR 52.212-5 shall be included in the IFB or Request For Proposals (RFP). Where different completion dates for separate parts or stages of the work are specified in the contract, this clause should be revised appropriately to provide for liquidated damages for delay of each separate part or stage of the work. Where multiple items are required (e.g., housing) the damages should include a price per day per unit basis even though the contract may have only one completion date. The liquidated damages set forth in Table 1, below, shall be used for all construction projects, except those specifically identified and covered in Tables 2 through 5. These liquidated damages tables are based upon those losses the Government is expected to suffer because of the failure of the contractor to complete the work on time, such as the cost of substitute facilities, the rental of buildings, or the continued payment of quarters allowances. In an exceptional case liquidated damages may be varied when the OICC determines that the Government's anticipated loss from delayed completion is estimated to be significantly in excess of these amounts. In such an exceptional case, a justification for each exceptional determination (including arithmetical computations) shall be made for the files and liquidated damage variations exceeding 50 percent shall require prior NAVFACENGCOM approval.

Courts and Boards refuse to enforce liquidated damages provisions which are unreasonable when compared to the contract price. Usually Courts and Boards will not reduce unreasonable liquidated damages specified to an amount they consider reasonable, but will strike such provisions in their entirety. If structures are occupied during the work, as in the case of the contract for exterior painting, the Table amounts are unrealistically excessive and must be reduced to realistic levels.

Table 1: General Construction Projects

Estimated Project Cost	Liquidated Damages Per Calendar Day	Estimated Project Cost	Liquidated Damages Per Calendar Day
Up to $2,000	$2	$10,000 to $50,000	$25
to		50,000 to 100,000	50
5,000	5	100,000 to 500,000	100
to			
10,000	10	Each additional 100,000, add	25

Table 2: Family Housing Units

Type of Units	Liquidated Damages Per Calendar Day Per Unit
GOQ (General Officers' Quarters)	Average daily Basic Allowance (BAQ) with dependents plus average Variable Housing Allowance (VHA)
SOQ (Senior Officers' Quarters)	
FGO (Field Grade Officers)	
CGO (Company Grade Officers)	
SEM (Senior Enlisted Men)	
JEM (Junior Enlisted Men)	

Table 3: Unaccompanied Personnel Housing

Type of Housing	Liquidated Damages Per Calendar Day Per Man		No. of Men Per Building		Liquidated Damages Per Calendar Day Per Building
UOPH	$10	x	______	=	______
UEPH	$ 8	x	______	=	______

Table 4: Storage Space

Liquidated Damages Per Calendar Day Per Square Foot		Square Feet		Liquidated Damages Per Calendar Day
$.03	x	______	=	______

Table 5: Office Space

Liquidated Damages Per Calendar Day Per Square Foot		Square Feet		Liquidated Damages Per Calendar Day
$ .05	x	______	=	______

Normally liquidated damages should not be allowed to accummulate in excess of 15 percent of the contract price. Excessive liquidated damages indicate poor contract administration (e.g., failure to insure time extensions or to terminate for default). When contractors are substantially behind schedule they should be terminated, or a new completion date negotiated for appropriate consideration. Contact NAVFACENGCOM for guidance and authority when damages approach 10 percent of the contract price.

4-213 STATUTORY COST LIMITATIONS. Construction of certain types of facilities are subject to statutory cost limitations. When the specifications are being prepared for a contract for work subject to statutory cost limitations, the appropriate NAVFACENGCOM Project Manager shall be contacted to assure that the OICC has the most current and applicable statutory cost information. Normally the statutory cost limitations will be specifically set forth in the IFB. In addition, if only a portion of the contract work is subject to statutory cost limitation, the successful bidder may be required after bid opening but prior to award, to submit a separate price breakdown of those portions of the work which are subject to the statutory cost limitations.

4-214 GOVERNMENT-FURNISHED EQUIPMENT AND MATERIAL. (FAR 45.105, 45.303, 45.309) Government-furnished equipment and material should not be used:

(a) where equally satisfactory equipment can be furnished by the contractor at comparable cost to the Government; and

(b) where delivery of the equipment and/or material to the job site cannot be reasonably assured to prevent delays in construction schedules.

Government-furnished equipment may be used:

(a) where complex, specially manufactured long lead time equipment is required;

(b) where significant economy can be realized from mass procurement without jeopardizing construction cost or schedule;

(c) where there is a necessity for standardized equipment within a system; and

(d) where surplus equipment is available and can be effectively used in lieu of procuring new equipment.

Pertinent information on the specific materials and equipment to be furnished by the Government must be included in the project specifications or on the drawings. Great care should be taken to assure that the Government-furnished material and equipment are available at the time and in the quantity and quality specified to avoid subsequent claims and liabilities.

Whenever possible, it is advisable to have the contractor responsible for providing all material and equipment. A Property Administrator shall be designated for each contract involving Government property furnished to or acquired by the contractor. This person shall be designated by and be responsible to the OICC for carrying out the appropriate duties and responsibilities outlined in ASPR Supplement 3.

4-215 TRANSPORTATION. (ASPR Supplement No. 3, FAR Part 47)

(a) Except in unusual circumstances, NAVFACENGCOM contracts should require the contractor to furnish all required transportation. Experience has established that where the Government attempts to provide transportation, supplies are frequently damaged enroute, late in being delivered or similar difficulties encountered. OICC's may provide transportation in those instances where normal commercial transportation is not available to the contractor, (e.g., construction contracts requiring construction in remote Arctic locations); where significant cost savings will accrue to the Government through the use of Government bills of lading or in other circumstances where the OICC determines it will be in the best interest of the Government to assume the responsibility for transportation.

(b) The following FAR transportation clauses are to be inserted, where applicable (unless otherwise noted), in fixed price supply and/or construction contracts:

(i) FAR 25.704 and 52.225-11 "Certain Communist Areas" (Mandatory clause).

(ii) FAR 47.4 and 52.247-63 "Preference for United States Flag Air Carrier (1975 NOV)".

(iii) FAR 42.1406 and 52.242-12 "Report of Shipment (RESHIP)".

(iv) FAR 47.507 and 52.247.64 "Preference for Privately Owned U.S.-Flag Commercial Vessels".

(c) See 2-311 for FAR clauses applicable to contracts involving ocean shipping.

4-216 PLANT INSPECTION. (46.402)

4-216.1 Prime Contracts. Normally, NAVFACENGCOM does not award prime contracts requiring inspection in a manufacturer's plant. In those instances where such contracts are awarded, they normally will be assigned to the Defense Contract Administration Services for administration. Contracts that are assigned to the Defense Contract Administration Services must include special provisions (See 2-111). In those instances where a manufacturer's plant is not under the cognizance of the Defense Contract Administration Services, the OICC may provide plant inspection with forces or arrange for such inspection to be provided by another EFD or DCAS.

4-216.2 Subcontracts. (FAR 46.405) Construction contracts frequently require the prime contractor to furnish major items of mechanical equipment such as boilers, air conditioning units, etc. In such cases, arrangements can be made for the Defense Contract Administration Service to perform plant inspection. Normally, this is accomplished by forwarding a letter to the cognizant Defense Contract Administration Service Office, specifically identifying the nature of the inspection services desired and specifically setting forth the extent and authority to be exercised by the inspecting personnel. This latter point cannot be overemphasized since contract administration officers normally have full administrative authority for contracts and unless this authority is specifically limited they may take undesired action such as authorizing substitution of materials, changing dimensions, etc. If no Defense Contract Administration Services Office has been assigned cognizance of the manufacturer's plant involved, the OICC may arrange for inspection by Navy personnel if so desired.

4-217 FORM OF CONTRACT PROVISION. It is essential that the provisions of Division One properly identify all the terms, conditions and provisions which will be applicable to the awarded contract by title, date, and number of pages. (See 4-103.2)

4-218 WARRANTIES. (FAR 46.7)

4-218.1 General Policy. Except where a warranty provision is included in the standard contract forms, it is the policy of NAVFACENGCOM not to include special warranty provisions. Past experience has established that warranties increase contract costs while not significantly increasing the ability of the Government to obtain corrective action or reimbursement for obtaining corrective action from other sources than the contractor.

4-218.2 Standard Commercial Warranties. OICC's may include a warranty clause which is standard or customary in the trade provided it is reasonably established that such clause will not increase the contract price, and that inclusion is in the best interest of the Government.

4-218.3 Enforcement of Warranties. Whenever construction work or other material is procured under a contract containing a Warranty or Inspection and Acceptance clause, and upon completion is turned over to the user or customer, the OICC/ROICC must remain available to provide assistance to the user in the enforcement of those contract provisions. Responsibility for day-to-day contact with contractors to obtain service under these contract provisions remains with the users. If a contractor is refusing to honor those contractual obligations, then the duty falls upon the OICC/ROICC to initiate action under contract administration procedures to either compel performance or obtain compensation for the United States, including referral through channels to NAVFACENGCOM for a Final Decision of the Contracting Officer, if necessary. Note that obligations under both the Warranty and the Inspection and Acceptance clauses survive contract close-out. Users should be advised by the OICC/ROICC of availability for this purpose. In any event, all parties concerned should be made aware of the necessity for prompt notice to the contractor of the existence of defects. PWO's, OICC's, and ROICC's should refer questions concerning the applicability of these clauses to the EFD 02 for guidance.

4-219 SECURITY PROVISIONS. (FAR 4.4) OICC's in conjunction with the EFD Security Officer shall assure that contracts which require the contractor to possess classified materials or to work in classified areas include appropriate security provisions and are properly administered.

4-220 SMALL BUSINESS SET-ASIDES. (FAR 19.1 and 19.5)

(a) All procurements for construction, alteration, or repairs, including maintenance, under $2,000,000 shall be considered as though the Small Business Specialist had initiated a set-aside request, and the procedures of FAR 19.5 shall apply. Proposed procurements of $2,000,000 or more for construction shall be considered on an individual basis. For procurements in other areas, the assigned Small Business Specialist should follow the procedures in FAR 19.5.(See 5-205 for A/E criteria)

(b) FAR 19.5 sets forth the policy and procedures governing (1) contract awards to small business concerns, (2) relationships with the Small Business Administration (SBA), (3) small business set-asides, and (4) small business subcontracting. Small Business Specialists should be completely familiar with these provisions.

(c) When a contract is set-aside for small business, the applicable size standard shall be included in the specifications with the notice in FAR 19.508.

4-221 LABOR PROVISIONS. (FAR Part 22) There are several mandatory provisions concerning contractor-employee benefits, working conditions, and wage rates. These provisions are subject to frequent change. Accordingly, OICC's should be thoroughly familiar with the contractor labor relations manual NAVFACENGCOM P-386 and should establish a close working relationship with the EFD Labor-Relations Specialist.

4-222 OCEAN SHIPPING. See 2-310

4-223 GOVERNMENT FURNISHED UTILITIES. (FAR 36.514) If Government utilities are going to be made available to the contractor, the contract specifications must clearly delineate the particular utilities to be furnished without charge, those which will be furnished at prevailing rates, the location of connections, voltage, size of pipes and similar information. See 7-901.

4-224 PRIORITY RATINGS AND EXPEDITING OF MATERIAL AND EQUIPMENT.

4-224.1 Mandatory Requirement. Under the current priorities and allocations system, the use of priority ratings on both DOD contracts and purchase orders and contractor placed orders is mandatory. Ratings must be applied to contracts and purchase orders at the time such contracts or orders are issued. A contract or purchase order is "rated" by writing on the contract or order, or on a separate paper specifically identified to the contract or order; the prefix DO or DX, as appropriate; followed by the authorized program identification; the date(s) delivery required; and a certification statement as prescribed by DMS Reg. 1. The certification statement must be signed by and include the Title of an Authorized Official.

4-224.2 Contracts Administered by OICC's Covering NAVFACENGCOM Contracts, Civil Works Projects and Navy Family Housing. All maintenance and construction under NAVFACENGCOM contracts, regardless of the type of funds used, all construction under Civil Works Appropriation, and all Navy Family Housing will be issued C2 (construction) ratings except when a higher rating is specifically authorized.

(a) It should be noted that in the case of Civil Works Projects the prime contractor may have previously been issued a priority rating for the overall project. However, the facility will need an individual construction rating under the C2 (Construction Program) which should be issued by the OICC to the prime contractor immediately upon designation as OICC.

(b) Contracts Over $100,000. Prime contractors shall be instructed to submit to NAVFACENGCOM, Military Readiness Division,, as early as practicable, an original and one copy of a "Statement of Controlled Materials Requirements" on Form DMS-4A (production or research and development) or Form DMS-4C (construction).

(c) Contracts Over $500,000. Prime contractors shall be instructed to submit to this Command, Military Readiness Division, an original and one copy of "Detailed Breakdown of Controlled Materials Requirements" on Form DMS-4S in addition to Form DMS-4C on contracts awarded in excess of $500,000. Supplemental Forms DMS-4A, DMS-4C, DMS-4S may be submitted at any time.

(d) Contracts Not Exceeding $100,000. Form DMS-4C is not required where the special procedure for small construction projects is used.

(e) Informal Contracts and Yard Labor Projects. All maintenance and construction performed by yard labor forces or by informal contract, regardless of the type of funds used, will be assigned a C3 (MRO) rating.

4-224.3 Expediting Delivery of Materials and Equipment. Special Priorities Assistance will be requested promptly whenever the promised delivery of materials is too late to permit maintenance of a required schedule. Requests for priorities assistance may be prepared by a prime or subcontractor, or by any responsible office in the Navy on a U.S. Department of Commerce, Industry and Trade Administration Form ITA-999. OICC's or ROICC's can assist the contractor in preparing this form to assure that all required information is provided. Contractors, OICC's and/or ROICC's must expedite through their cognizant DCASO and if the problem is not resolved, properly endorse Form ITA-999 as soon as possible to the next echelon.

4-224.4 NAVFACENGCOM Assistance. NAVFACENGCOM, Military Readiness Division, should be contacted for assistance in connection with priorities and expediting material and equipment delivery.

4-225 MULTIPLE PROJECTS. (Military Construction Authorization Act) In those instances where it is determined to be in the best interest of the Government to accomplish the construction of more than one project under a single contract, and the estimated cost of one or more of the projects is $200,000 ($200,000 used to avoid exceeding escalation limitations) or greater, the following shall be included in the provisions of the bidding documents:

> "Prior to award the low conforming bidder shall furnish immediately upon receipt of a request from the Officer in Charge of Construction, a breakdown of the bid specifically setting forth the proportionate share of the total bid price attributable to the construction of each of the following: (Specifically cite the project or projects affected.)"

4-226 AWARD PROVISIONS. (14.407)

4-226.1 General. Except as indicated below, IFB's shall provide that award will be made to the responsible bidder whose bid, conforming to the IFB, is most advantageous to the Government, . price and other factors considered. (See SF22, Article 10 and NAVFACENGCOM Instruction to Bidders, Article 10)

4-226.2 Additive or Deductive Bid Items. When additive or deductive bid items are used, award provisions shall be as provided for in 4-201.3(f).

4-226.3 Unit Prices. Except in unusual circumstances, where a split award may be possible and desired, contracts to be awarded on the basis of unit prices, shall include a statement that award will be based on performance of all the work and that a split award will not be made. (See 4-201.6)

REFERENCES

1. American Society of Civil Engineers, Official Register, 1981, New York, p. 294.

2. Black, Henry Cambell, M. A., Black's Law Dictionary, revised 4th ed., West Publishing Company, St. Paul, 1968, p. 972.

3. Interview with Frank Still, Project Engineer, CRS-Sirene, February, 1987.

4. Interview with Lloyd Kelly, Project Manager, Gilbane, March, 1987.

5. Interview with Frank Still.

6. Interview with Lloyd Kelly.

7. Nigro, William T., "Contract Documents: A Quality Control Guide", Architecture, January 1987, p. 82.

8. Ibid.

9. Nigro, op. cit., p. 85.

10. Nigro, William T., "Redicheck", The Military Engineer, September-October 1983, p. 421.

11. Nigro, op. cit., p. 423.

12. Parker, Donald E., Value Engineering Theory, The Value Foundation, Washington, D. C., 1977, p. 18.

13. Simon, Michael S., Esq., Construction Contracts and Claims, McGraw-Hill Book Company, New York, 1979, p. 1.

14. Simon, op. cit., p. 6.

15. Simon, op. cit., p. 68.

16. Ibid.

17. Ibid.

18. U. S. Navy, Chesapeake Division, Naval Facilities Engineering Command, *ROICC Contract Administration Handbook*, CHESNAVENGCOM INST 4330.62C, Naval Publications and Forms Center, Philadelphia, 1984, p. 8.

19. *Ibid*.

20. U. S. Navy, Chesapeake Division, Naval Facilities Engineering Command, *op. cit.*

21. U. S. Navy, Naval Facilities Engineering Command, *Constructibility Reviews*, NAVFAC P-446, Naval Publications and Forms Center, Philadelphia, 1984, p. (i).

22. U. S. Navy, Naval Facilities Engineering Command, *Constructibility Reviews*, NAVFAC P-446, Naval Publications and Forms Center, Philadelphia, 1984.

23. U. S. Navy, Naval Facilities Engineering Command, *Contracting Manual*, NAVFAC P-68, Naval Publications and Forms Center, Philadelphia, 1985, pp. 3.4.1 - 3.4.3.

24. U. S. Navy, Naval Facilities Engineering Command, *Contracting Manual*, NAVFAC P-68, Naval Pulications and Forms Center, Philadelphia, 1985, pp. 4.2.1 - 4.2.18.

25. U. S. Navy, Naval Facilities Engineering Command, *Contracting Manual*, NAVFAC P-68, Naval Publications and Forms Center, Philadelphia, 1986, Appendix J.

26. U. S. Navy, Southern Division, Naval Facilities Engineering Command, *Review of Plans, Specifications, and Cost Estimates*, SOUTHNAVFACENGCOM Instruction 11012.10A, January 1983.

27. Vaughn, Richard C., *Legal Aspects of Engineering*, 4th ed., Kendall/Hunt Publishing Company, Dubuque, Iowa, 1983, p. 7.

BIBLIOGRAPHY

American Society of Civil Engineers, Official Register, 1981, New York.

Black, Henry Cambell, M. A., Black's Law Dictionary, revised 4th ed., West Publishing Company, St. Paul, 1968.

Interview with Frank Still, Project Engineer, CRS-Siréne, February, 1987.

Interview with Lloyd Kelly, Project Manager, Gilbane, March, 1987.

Nigro, William T., "Contract Documents: A Quality Control Guide", Architecture, January 1987, pp. 82-85.

Nigro, William T., "Redicheck", The Military Engineer, September-October 1983, pp. 420-423.

Parker, Donald E., Value Engineering Theory, The Value Foundation, Washington, D. C., 1977.

Simon, Michael S., Esq., Construction Contracts and Claims, McGraw-Hill Book Company, New York, 1979.

U. S. Navy, Chesapeake Division, Naval Facilities Engineering Command, ROICC Contract Administration Handbook, CHESNAVENGCOM INST 4330.62C, Naval Publications and Forms Center, Philadelphia, 1984.

U. S. Navy, Naval Facilities Engineering Command, Constructibility Reviews, NAVFAC P-446, Naval Publications and Forms Center, Philadelphia, 1984.

U. S. Navy, Naval Facilities Engineering Command, Contracting Manual, NAVFAC P-68, Naval Publications and Forms Center, Philadelphia, 1985.

U. S. Navy, Southern Division, Naval Facilities Engineering Command, Review of Plans, Specifications, and Cost Estimates, SOUTHNAVFACENGCOM Instruction 11012.10A, January 1983.

Vaughn, Richard C., Legal Aspects of Engineering, 4th ed., Kendall/Hunt Publishing Company, Dubuque, Iowa, 1983.

183547

DUDLEY KNOX LIBRARY
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA 93943-5002

Thesis
W651245 Winsper
c.1 Design constructibility reviews.

Thesis
W651245 Winsper
c.1 Design constructibility reviews.

thesW651245
Design constructibility reviews.
3 2768 000 72493 4
DUDLEY KNOX LIBRARY